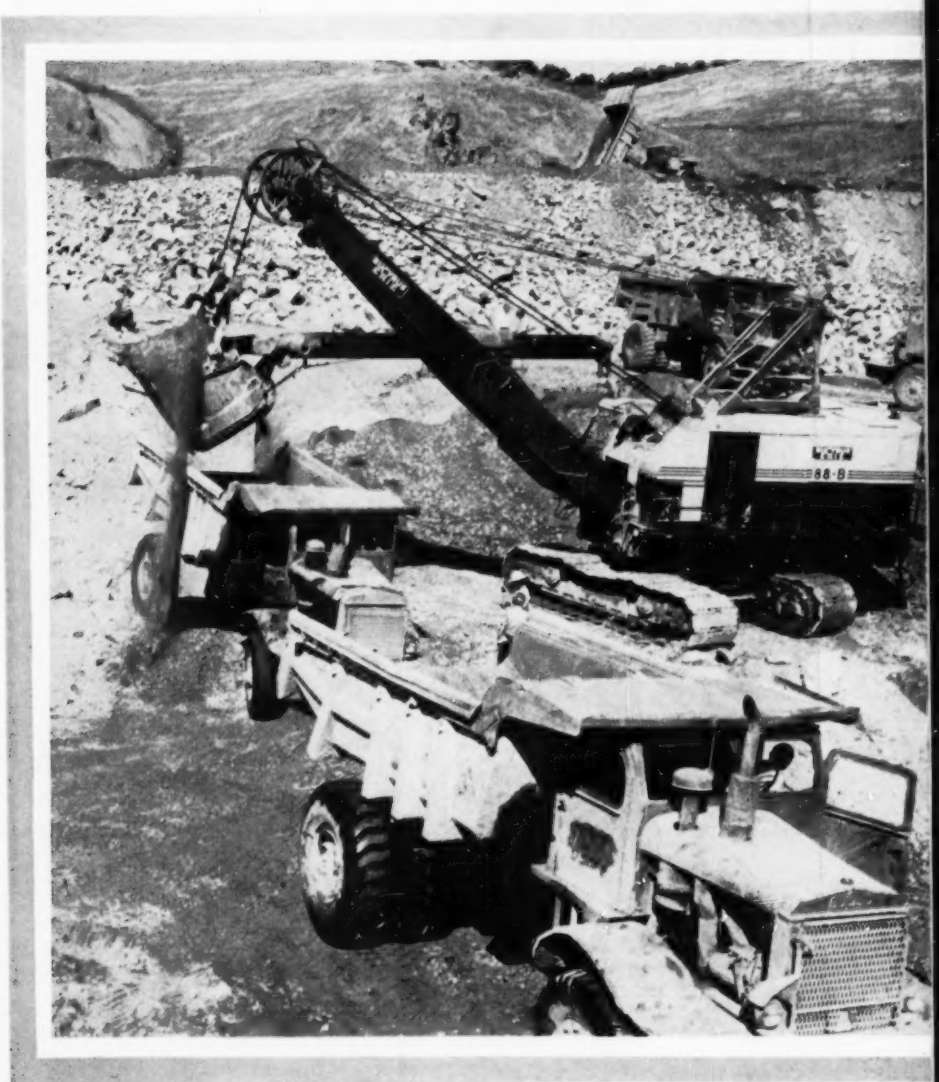
DIESEL POWER

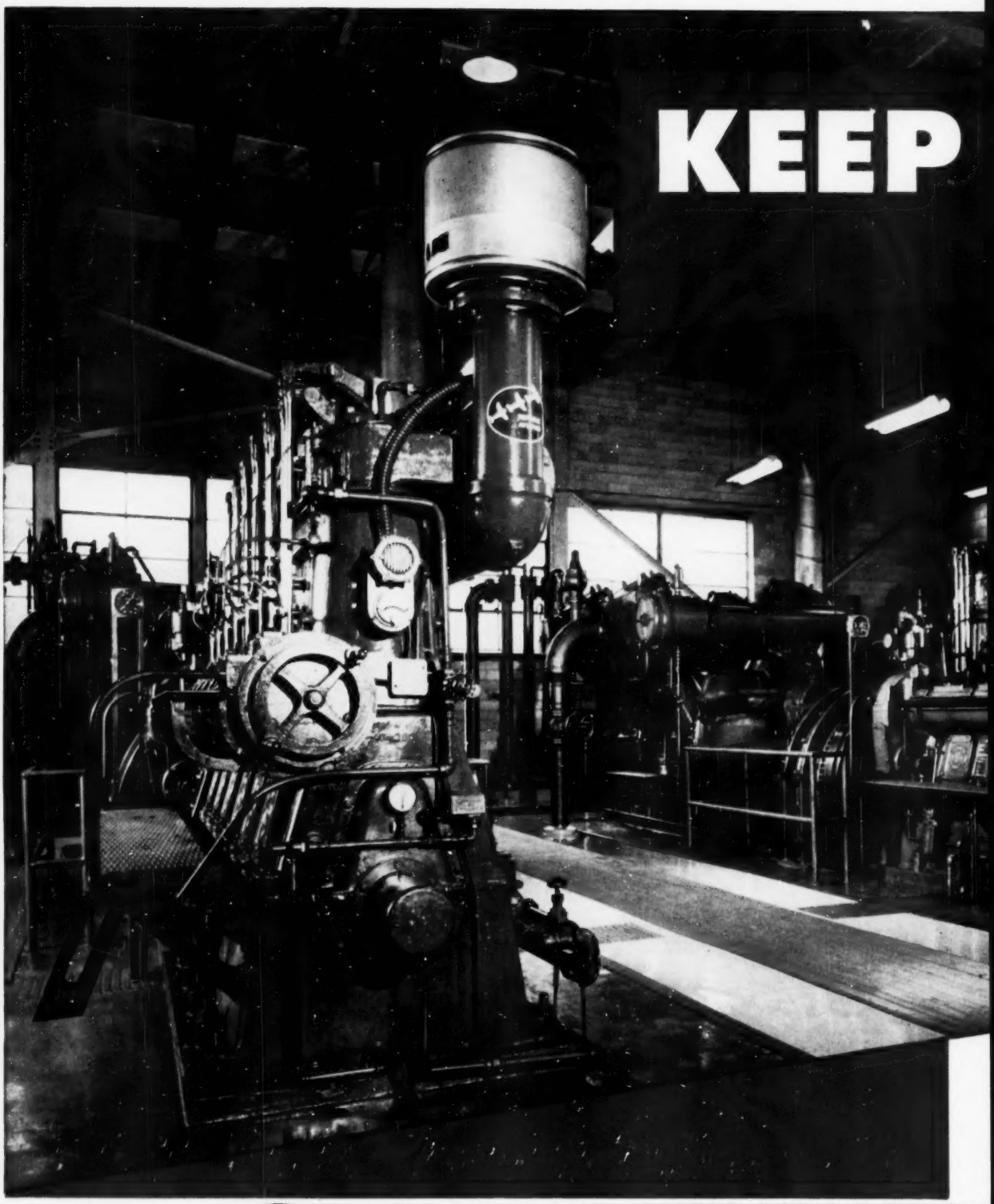
AND DIESEL TRANSPORTATION

April, 1952

● *Governing Mack's Diesels*



DIESEL ENGINE SPECIFICATIONS



TUNE IN . . . TEXACO
STAR THEATER
starring MILTON BERLE
on television
every Tuesday night.
See newspaper for
time and station.

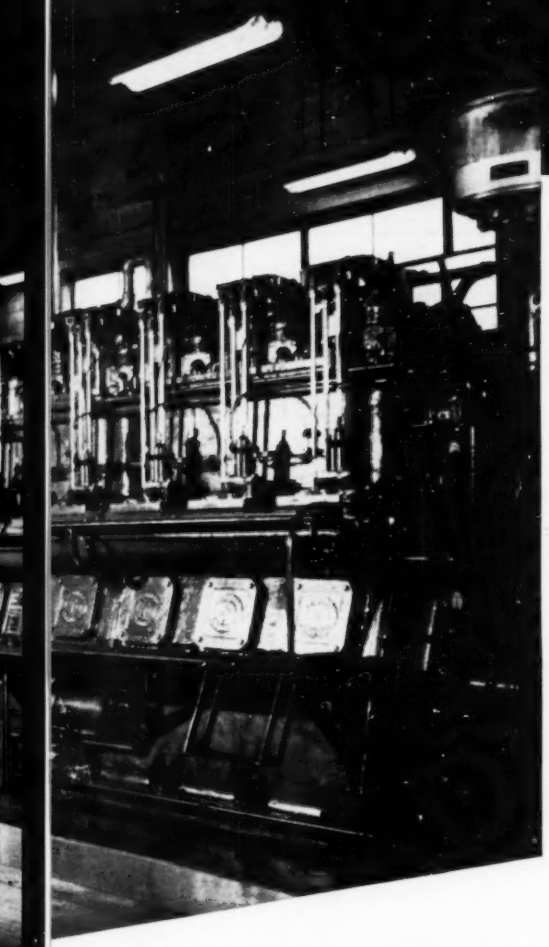
TEXACO

TEXACO

DIESEL POWER and DIESEL TRANSPORTATION for April 1952, Vol. XXX, No. 4. It is published monthly by Diesel Publications, Inc., Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Subscription rates: United States, $3.00 per year, single copies 35¢; Canada $4.00; Foreign $5.00 per year. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut under Act of March 3, 1879.

RINGS FREE

...reduce fuel consumption and maintenance costs



Power plant, Republic Aviation Corp., Farmingdale, N. Y. — lubricated exclusively with *Texaco Ursa Oil.*

. . . lubricate with TEXACO URSA OIL

You reduce fuel consumption and maintenance costs when you lubricate Diesel, gas or dual-fuel engines with *Texaco Ursa Oil.* Here's an oil that *cleans as it lubricates* — keeps engines in tip-top shape for maximum performance at minimum expense.

Texaco Ursa Oil stands up under the toughest operating conditions . . . resists oxidation and the formation of carbon, sludge and gum. Thus, rings stay free, ports stay clear, valves work smoothly. You get better compression and combustion. Fuel consumption comes down. Maintenance costs, too — because *Texaco Ursa Oil* assures smoother operation, less wear.

There is a complete line of *Texaco Ursa Oils.* Leading engine builders approve them, and operators everywhere prefer them. In fact —

For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco Ursa Oil than with any other brand.

Let a Texaco Lubrication Engineer help you get best possible performance from all your engines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

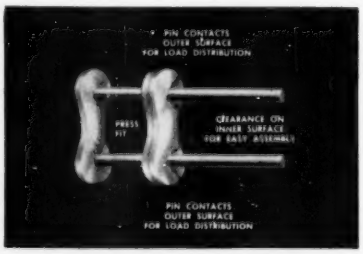
URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Faithfully yours 50 *for Fifty Years*

...the chain that has extra fatigue life

Thousands of tiny steel balls hammer the metal — "cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

LINK-BELT Precision Steel Roller Chain ...with SHOT-PEENED rollers



Easier coupling
and uncoupling without sacrificing load distribution

Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains — right on the job — is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, flexible, economical, long-life drive.

Link-Belt Roller Chain is available in single or multiple widths, in ⅜ to 3 in. pitch. For all the facts, call the Link-Belt office near you.

12,773

LINK-BELT

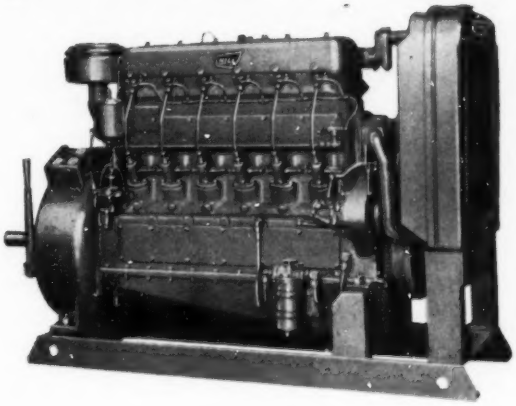
PRECISION STEEL ROLLER CHAIN

LINK-BELT COMPANY: Chicago 9 Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, factory branch stores and distributors in principal cities.

If You Want . . .

- **LOWER ORIGINAL COST**
- **LOWER OPERATING COST**
- **LONGER DEPENDABLE SERVICE**
- **QUICKER DELIVERY**
- **SIMPLICITY AND ACCESSIBILITY**

you can't beat HILL DIESEL

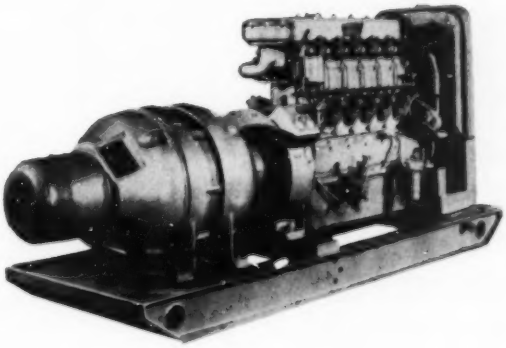


ENGINES & POWER UNITS

The Hill Model 6F Power Unit, shown at the left, is the largest of the "F" Series. This 6 cylinder unit is rated at 70 horsepower (intermittent duty) at 1800 r.p.m. The heavy-duty power take-off is standard equipment. Also available in the "F" series is a 4 cylinder model with an intermittent duty rating of 46 horsepower at 1800 r.p.m., and a 2 cylinder model with an intermittent duty rating of 19 horsepower at 1600 r.p.m.

ELECTRIC GENERATING SETS

Hill Series "F" Electric Generating Sets combine a 4-stroke-cycle Diesel engine with an efficient generator to provide dependable power. Generators are available with characteristics matching those of commonly used power systems; generators with unusual characteristics can be built to order. Units start easily on Diesel fuel, with no preheating required. Available accessory equipment meets requirements of any installation. Out-put range is from 7.5 to 30 KW for either A.C. or D.C.



All your diesel power requirements from 12-90 horsepower can be provided better by Hill Diesel.

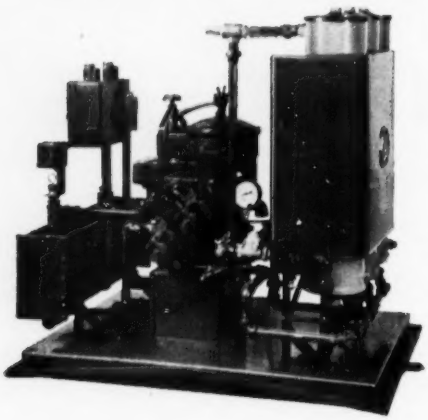
FOR FULL INFORMATION WRITE

HILL DIESEL ENGINE CORPORATION

238 MILL STREET **LANSING, MICHIGAN**

INCREASES OIL LIFE

THE DE LAVAL "PURI-FILTER"



Note these Features

- Removes dirt and water by centrifugal force
- Filters out harmful carbon
- Does not remove valuable additives
- Cleans oil at moderate temperature
- Speeds up inspection—crankcase is cleaner
- Minimizes ring sticking
- Increases bearing life
- Saves labor—long runs without bowl cleaning

No dirt . . . carbon . . . or water

Because it provides the best means ever devised for keeping diesel oil clean, the De Laval "Puri-Filter" extends the useful life of the oil indefinitely. Centrifugal force, applied within the bowl of a De Laval "Uni-Matic" Oil Purifier first frees the oil of most solid impurities and all water. Then the oil passes through a Fram "Filcron" Filter, which removes colloidal carbon and other minute contaminants.

The De Laval "Puri-Filter" leaves the oil a clear translucent amber color. It is ***visibly*** clean, and thus provides the utmost in protection for every diesel engine.

Used to purify fuel oil, a De Laval centrifuge makes it possible to burn cheaper grades of residual fuel with perfect safety and an appreciable saving of money.

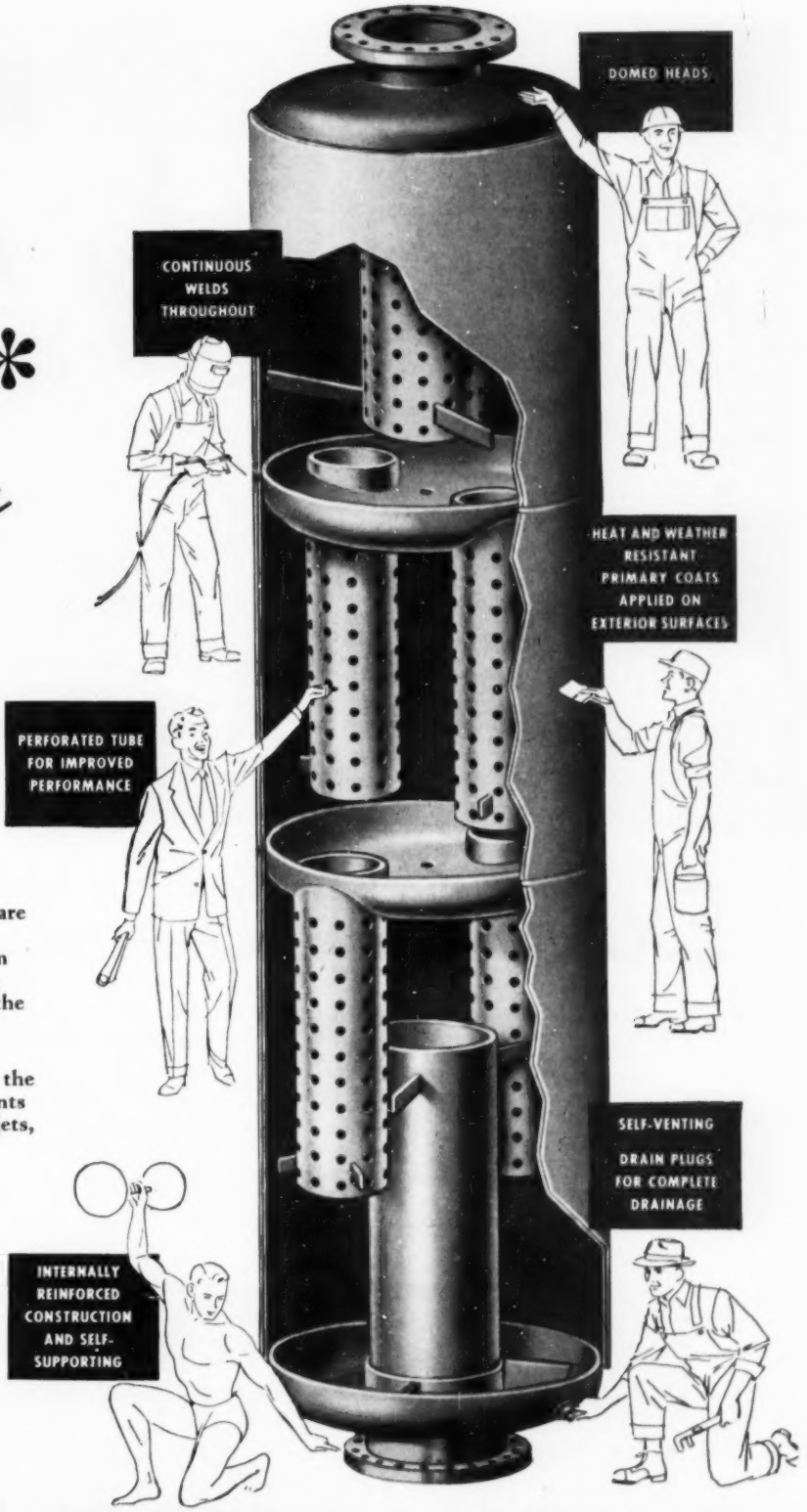
THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL *Oil Purifiers*

FOR DIESEL LUBRICATING OIL

Rugged Reliable Snubbers*

for quiet operation of engines and compressors


DOMED HEADS
CONTINUOUS WELDS THROUGHOUT
HEAT AND WEATHER RESISTANT PRIMARY COATS APPLIED ON EXTERIOR SURFACES
PERFORATED TUBE FOR IMPROVED PERFORMANCE
SELF-VENTING DRAIN PLUGS FOR COMPLETE DRAINAGE
INTERNALLY REINFORCED CONSTRUCTION AND SELF-SUPPORTING

Burgess-Manning Snubbers are soundly engineered, carefully fabricated by craftsmen from quality materials. Burgess-Manning Snubbers are built to meet the rugged operating conditions encountered in the field.

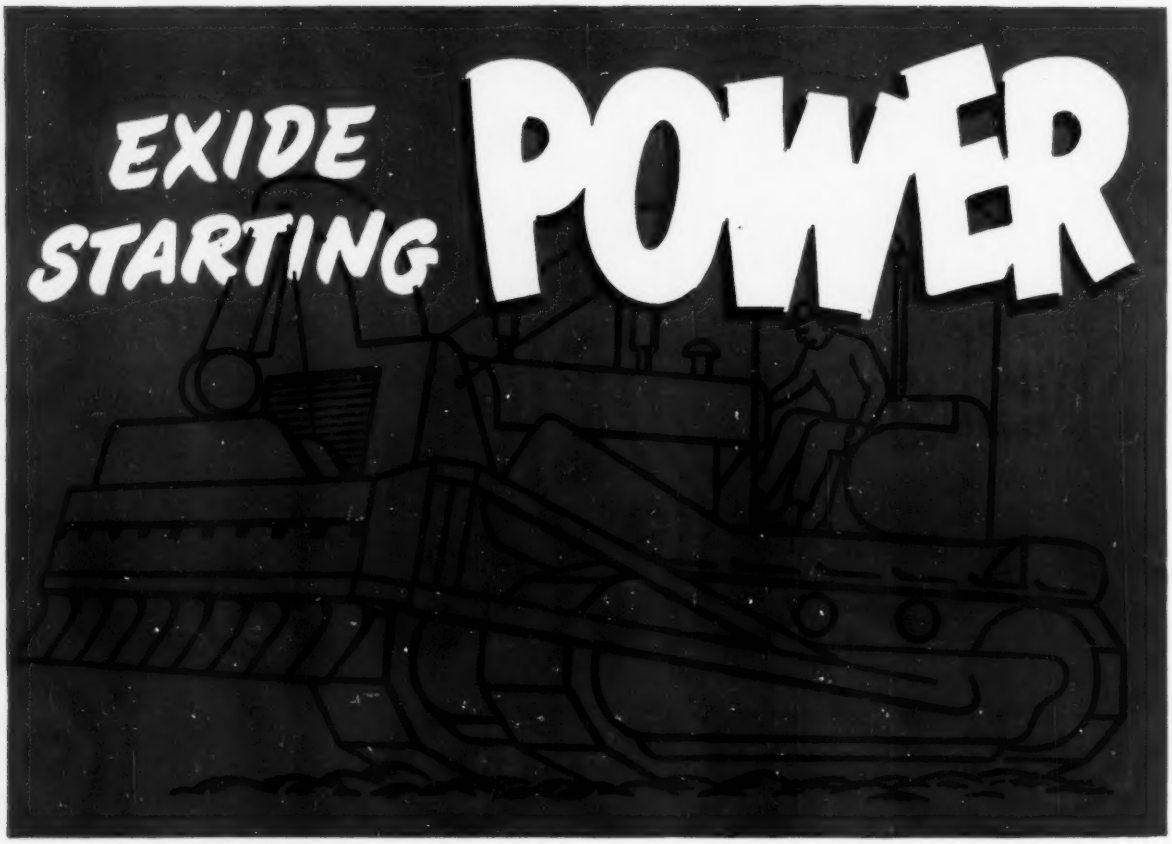
Snubbers are available to meet the exacting noise reduction requirements of your Diesel and gas engines, jets, turbines, blowers, compressors, and vacuum pumps.

* Choice of Snubbers from industrial silencing level to critical installations such as hospitals, hotels, office buildings, and residential areas.

BURGESS-MANNING COMPANY

Dallas, Texas • 749-B East Park Ave., LIBERTYVILLE, ILLINOIS • Chicago, Illinois

EXIDE STARTING POWER



Exide the battery that's ABLE and READY for the toughest diesel-starting job

Put dependability in your diesel starting! Give the job to Exide, the powerful, long-life batteries that are built specifically for the job. They're a product of years of research-engineering, designed to give you a battery you can count on day after day . . . in tough, rugged service . . . in all climates.

Exide diesel-starting batteries give you:

QUICK BREAKAWAY and fast acceleration of engine to firing speed.

LOW DEPRECIATION due to their extra long life.

LOW COSTS of operation and maintenance.

RUGGED CONSTRUCTION for rough usage in hard service.

Use Exide Diesel-Starting Batteries for heavy-duty service—in buses, trucks, tractors, off-the-highway equipment, ships, power plants, diesel-electric locomotives.

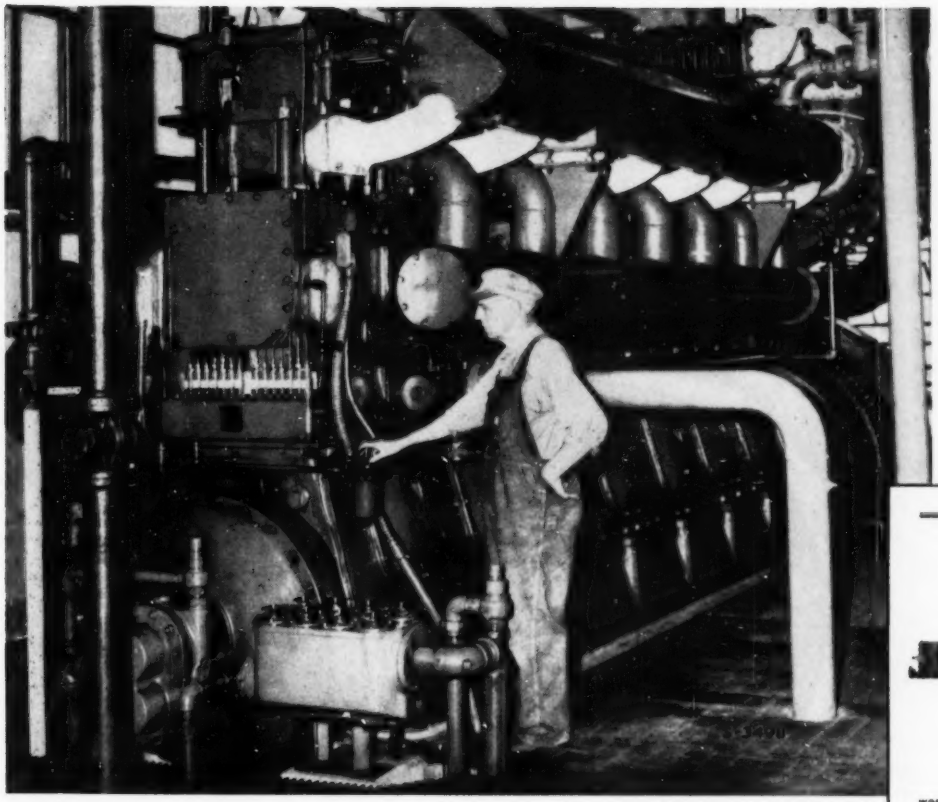
THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2

Exide Batteries of Canada, Limited, Toronto

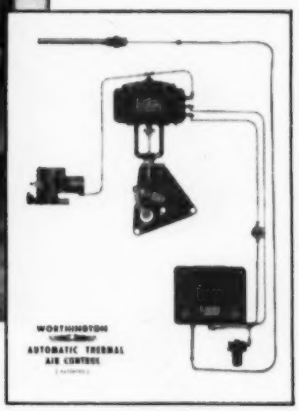
"Exide" Reg. Trade-mark U.S. Pat. Off.

WHEN IT'S AN Exide
YOUR DIESELS START

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952



WORTHINGTON 1,000-KW CAPACITY SUPERCHARGED DUAL FUEL DIESEL used in conjunction with municipal steam generating plant at David City, Nebraska.



Cost-per-kw down over 60% with Worthington Dual Fuel Engine

David City, Nebraska—this city has proof that the Worthington Dual Fuel Diesel can reduce power-plant operating costs.

Engineering of this installation—made in August, 1949—was under the direction of Black and Veatch, Kansas City, Mo., Consulting Engineers. At the present time the unit operates at only one-third capacity in supplementing steam power generation.

In spite of these poor load conditions, the David City plant's overall operating cost per kw was down 60% the first year this engine was used.

ONE BIG REASON YOU GET MORE EFFICIENCY FROM THIS ENGINE

Worthington's Automatic Thermal Air Control—an exclusive patented Worthington feature—is one of the biggest reasons you get more efficiency from this dual fuel engine—or from Worthington gas engines.

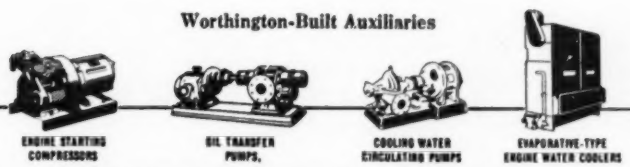
Unlike any air throttling mechanism dependent on governor action, this unit is actuated by engine exhaust temperature.

It maintains optimum air-fuel ratio at all times; provides automatic variation of air quantity in direct relation to ambient air temperatures; automatically compensates for changes in the heating values of the gas fuel (this would require manual adjustment where air-throttle controlled governor is used); maintains highest fuel economy at all loads regardless of changes in air temperature or fuel quality.

Worthington engines can increase *your* plant's efficiency and lower operating costs. For more facts on Dual Fuel or other engines, gas or Diesel, write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

E.I.13

Worthington-Built Auxiliaries



Economical Continuous Power—Diesel Engines, 150 to 2,640 hp . . . Gas Engines, 190 to 2,880 hp . . . Dual Fuel Engines, 150 to 2,640 hp.

WORTHINGTON
Engines

"OSH" Unit Oil Coolers
Engine Jacket Water Coolers
Intercoolers for Supercharged Gas, Gasoline and Diesel Engines
1927 • 1952
25 YEARS OF PROGRESS IN HEAT TRANSFER ENGINEERING
Young Quality
Fixed and Removable Type Shell and Tube Heat Exchangers
Evaporative Type Coolers and Condensers
"Mono-Weld" Sectional-Type Steel Tank and Side-Member Radiators
"HC" Tube and Fin Type Large Capacity Cooling and Condensing Units

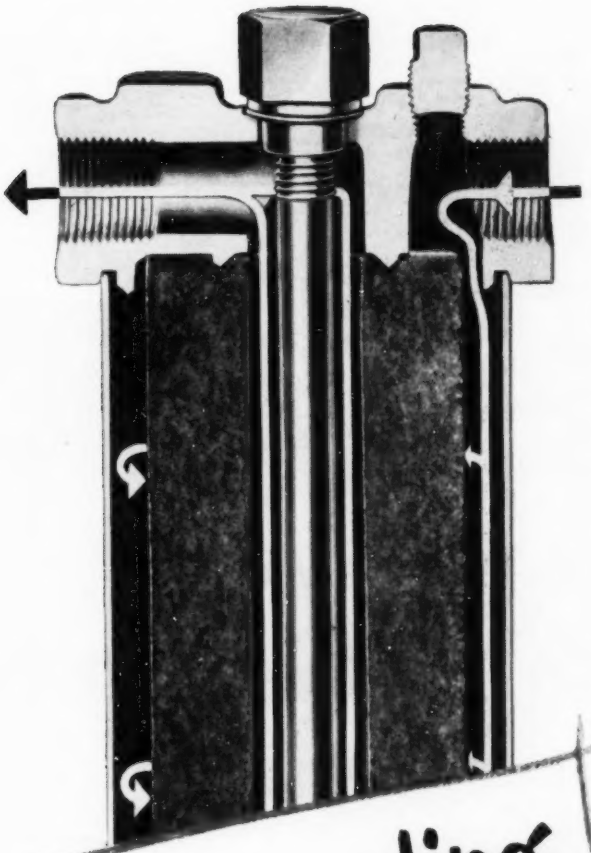
YOUNG

Heat Transfer Products for Automotive and Industrial Applications

Heating, Cooling, and Air Conditioning Products for Home and Industry.

DEPT. 412-D • RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois



No Channeling with this micronic filter

Won't shrink, won't swell. Won't harden, won't soften. Won't distort in any way. That's Cuno MICRO-KLEAN . . . the filter that outlasts any other replaceable-cartridge filter 2 to 1!

Build *This* into Your Engine Guaranteed Clean Oil

For cleaning Diesel fuel and lube, nothing gives you greater dependability than Cuno MICRO-KLEAN!

It is *guaranteed* to remove 100% of injurious solids larger than specified* plus a large percentage down to 1 micron.

Also, it's impervious to crankcase acids, moisture or other damaging agents. Will not distort, shrink, or rupture. Prevents clogged injector nozzles or damage to working parts.

Fewer Cartridge Changes

Maximum porosity (85-90%) of fibre-felted cartridge and exclusive "graded density in depth" reduce surface-loading and produce *double* the usual dirt-holding and flow capacity.

Less Space Needed

Greater capacity and absence of structural components cut down space needed. Thus, full-flow filtration of lube is now practical.

No Danger of Removing Additives

Filtration is accomplished by mechanical principles—no adsorptive or absorptive properties. Additives are not removed.

*Cuno MICRO-KLEAN cartridges are available in 10, 25 and 50 micron ratings. Capacities from a few to over 800 gpm.

CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

Cuno Engineering Corporation
Dept. 256D, South Vine St., Meriden, Conn.

Please send information on Cuno MICRO-KLEAN for Diesel service.

Name.....Title.....

Company.....

Address.....

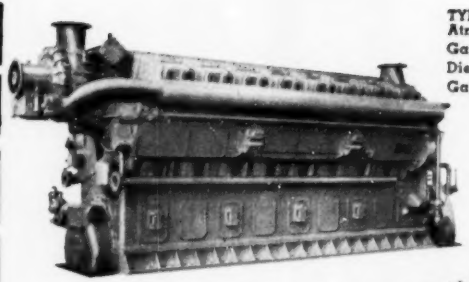
City.....Zone....State....

Please attach to business letterhead

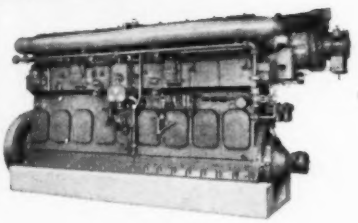
● Identified here are five of the most popular Cooper-Bessemer stationary engine types—in a power range from 290 to 3700 bhp. Not only does each type offer variety in the number of cylinders, but most are available as gas engines, gas-diesels or full diesels. Moreover each type comes either atmospheric or supercharged.

This gives you some idea of how well Cooper-Bessemer is prepared to meet your power requirements ideally — with the engine qualities that mean a whale of a lot in trouble-free service and especially in low over-all operating costs!

If your plans call for defense-supporting power, be sure to check with Cooper-Bessemer. Get all the facts on features that pay off for Cooper-Bessemer users time and time again.



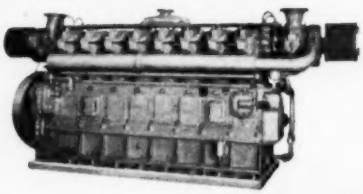
TYPE LSV ..... 12 or 16 cyl.
Atmospheric and Supercharged
Gas ..... 1440 to 3700 hp.
Diesel ..... 1650 to 3700 hp.
Gas-Diesel ..... 1650 to 3700 hp.



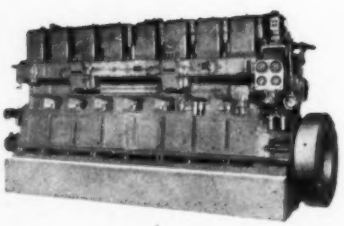
TYPE LS ..... 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 720 to 1850 hp.
Diesel ..... 825 to 1850 hp.
Gas-Diesel ..... 825 to 1850 hp

WHEN IT COMES TO POWER...

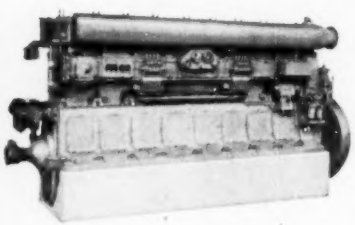
the better it "fits", the less it costs!



TYPE FV ..... 6, 8, 12 or 16 cyl.
Diesel—
Atmospheric ..... 290 to 1230 hp.
Diesel—
Supercharged .. 420 to 1850 hp.



TYPE JS ..... 5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 375 to 1500 hp.
Diesel ..... 430 to 1500 hp.
Gas-Diesel ..... 430 to 1500 hp

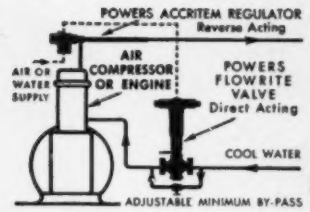


TYPE GS ..... 5, 6 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 320 to 1200 hp.
Diesel ..... 300 to 1200 hp.
Gas-Diesel ..... 300 to 1200 hp.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

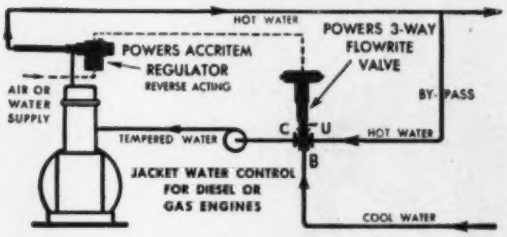
New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. Calmes Engineering Co., New Orleans, La.



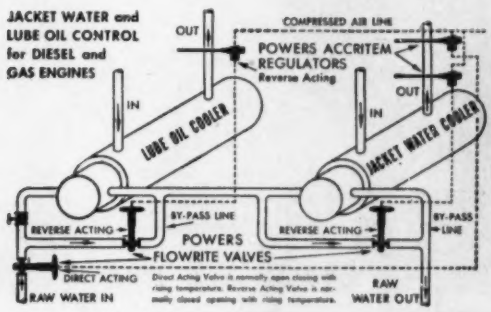
POWERS

ACCRITEM REGULATOR

Unsurpassed for reliability and power to operate large or small size 3-way or 2-way diaphragm valves for accurate control of jacket water and lube oil cooling temperatures.



Only a few of many applications are shown here.



Gives Accurate, Low Cost Heat Control

Use Accritem Regulators to control diaphragm operated valves or dampers. They save labor, stop losses caused by over-heating and have the following —

IMPORTANT ADVANTAGES

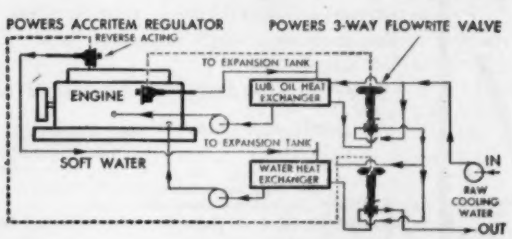
- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures many years of reliable service.
- ***Temperature Ranges*** 50 to 250° F. and 150 to 350° F.
- ***Easy to Install*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size*** — regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long with ½" I.P.S. connection.

Proper Cooling Temperatures assured by Powers Accritem Regulators

• Makes ignition easier • Prevents rapid breakdown of lube oil • Decreases cylinder and piston ring wear • Reduces danger of piston siezure • Lowers fuel and lube oil consumption

POWERS

FLOWRITE and METAFLOW Diaphragm Valves controlled by a POWERS ACCRITEM HEAT REGULATOR provide an unbeatable combination for *better control and lower maintenance*



Write for Bulletin 316 — or phone our nearest office for prices and further information about POWERS ACCRITEM regulators and diaphragm valves.

THE POWERS REGULATOR CO.

SKOKIE, ILL. • OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 13, ILL., 3819 N. Ashland Ave. • NEW YORK 17, N.Y., 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • TORONTO, ONT., 195 Spadina Ave.
MEXICO, D. F., Apartado 63 Bis.

AMD

60 Years of Temperature and Humidity Control

When They *Step up* Service in Shelbina...

Baldwin series 700 diesel engine of 750 hp at 300 r.p.m. uses Bendix Fuel Injection equipment.

BENDIX
FUEL INJECTION
and
BALDWIN
DIESEL ENGINES

Step in!

Municipal electric power has a 56 year history in Shelbina, Mo., a town of 2000 inhabitants, located about 100 miles northwest of St. Louis.

Diesel powered since 1932, the equipment used in Shelbina power plant has been progressively modernized to meet ever increasing capacity requirements. The latest addition is a Baldwin diesel series 700 with Bendix Fuel Pumps and Injection Equipment.

In the great advance that diesel power is making, Bendix fuel injection equipment, together with outstanding diesel engine manufacturers, is playing an increasingly important part.

SCINTILLA MAGNETO DIVISION of
SIDNEY, NEW YORK

Bendix
AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y.
Western Market Office: 582 Market Street, San Francisco 4, Calif.

Drawn above is a magnified view of two drops of Diesel lubricating oil taken from two new Diesel engines.

Which is the better diesel oil?

Chances are, you'd pick the clear clean oil on the right as the better oil . . . but you'd be wrong.

The clean oil is the "lazy" non-detergent oil. It has done a job of lubricating, but it has not done a proper cleaning job.

The better oil is the dirty oil. Its job has been well done. Not only did it provide complete, protective lubrication, but it actually washed the engine! . . . carrying out of the engine those microscopic, insoluble particles that would normally form harmful incrustations on vital engine parts.

The oil holding the dirt particles in suspension is Cities Service D-C 300 . . . one of the complete line of Cities Service Diesel Engine Oils. Its detergent-dispersant and anti-oxidation qualities assure longer, more trouble-free Diesel operation. This high V. I. heavy duty oil guarantees complete lubrication protection at highest engine speeds.

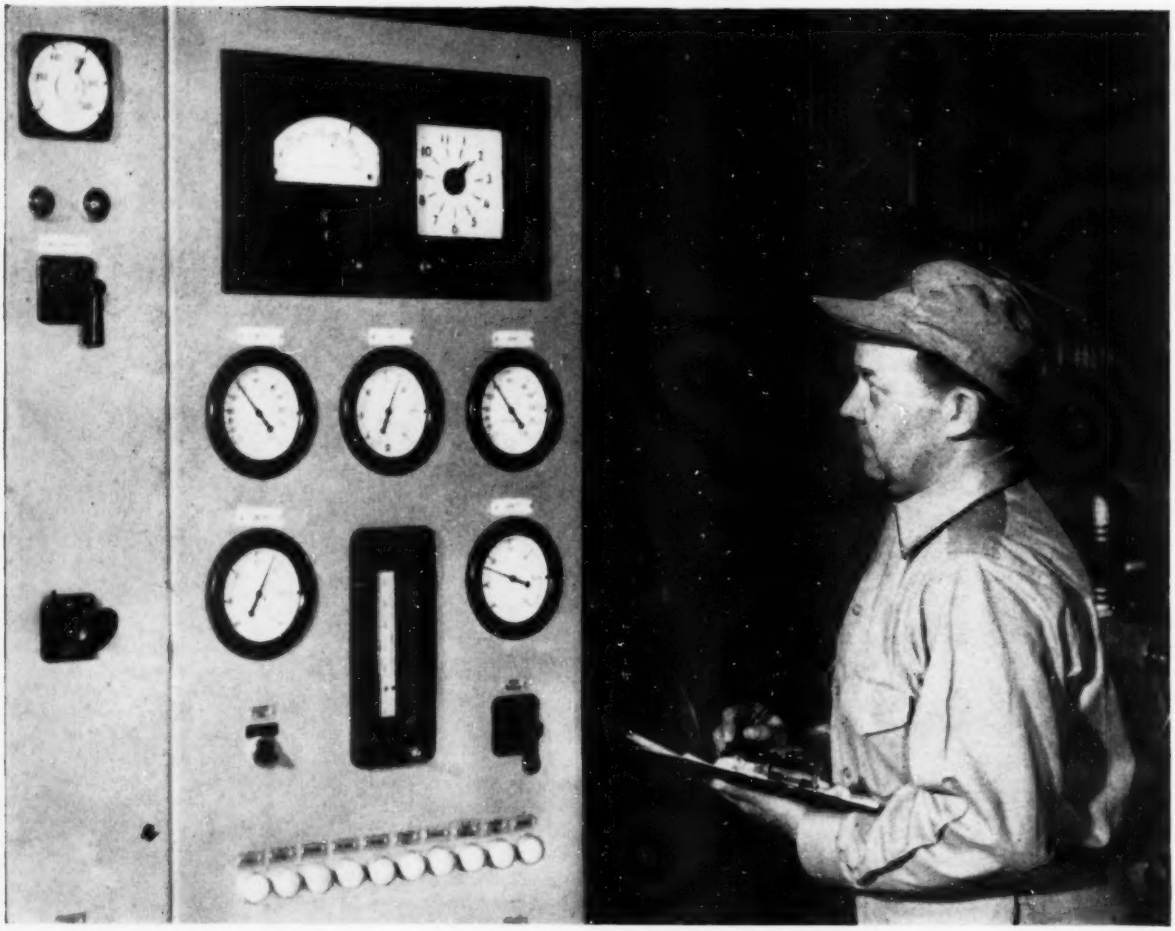
Why not discuss your operation with a Cities Service Lubrication Engineer. His experience and the complete line of scientifically-formulated Diesel lubricants can mean improved operating conditions for you. Write to CITIES SERVICE OIL COMPANY, Dept. D 12, Sixty Wall Tower, New York City 5 . . . or call the Cities Service Office nearest you.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Alnor PROTECTION

for KAISER POWER PLANT



The new Kaiser aluminum plant in Chalmette, Louisiana, is huge by every measure—35 acres of floor space . . . 150,000 h.p. diesel power plant . . . 46,000 lbs. of aluminum produced every hour . . . 24 hours a day.

Here, as at Alcoa's plant, the new Nordberg radial engine is used—80 units in all. Each engine is rated at 1820 h.p. . . . each engine works up a heat load of nearly 3,000,000 b.t.u.'s an hour —that calls for protection. And, like the Alcoa installation, that protection is supplied by the latest in protective equipment—the Alnor Pyrotac.

This precision-built instrument continuously monitors exhaust temperatures . . . automatically checks each cylinder every minute. Watching the pyrometer scale from as far away as 20 feet, you can instantly tell if any one cylinder is out of balance . . . allows supervision by a minimum force. The instrument can be wired to an alarm circuit to warn of excess temperatures and automatically shut down the engine when maximum safe temperatures are exceeded.

Such automatic, constant protection reduces maintenance time and expense to a minimum—increases efficiency and operating economy.

The Pyrotac presents many opportunities for improved instrumentation in the diesel and gas engine field. It can be used to warn of excess temperatures in cylinders, entire engines, overheated bearings, burn-out danger in fields of large generators, etc. Why not ask for Alnor assistance in solving your pyrometer problems today? Illinois Testing Laboratories, Inc., Room 507, 420 N. La Salle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

FAIRBANKS-MORSE

DUAL FUEL POWER SAVING OVER $19,000 A YEAR!

In the western Kansas city of Colby, Fairbanks-Morse Dual Fuel Engine economy has been making savings in fuel and lube oil that amount to over $19,000 annually!

But impressive as it is, that isn't the whole story. For this Model 33 Engine has been the mainstay of the plant—operating more than 96% of the time . . . generating more than 83% of the plant's total load.

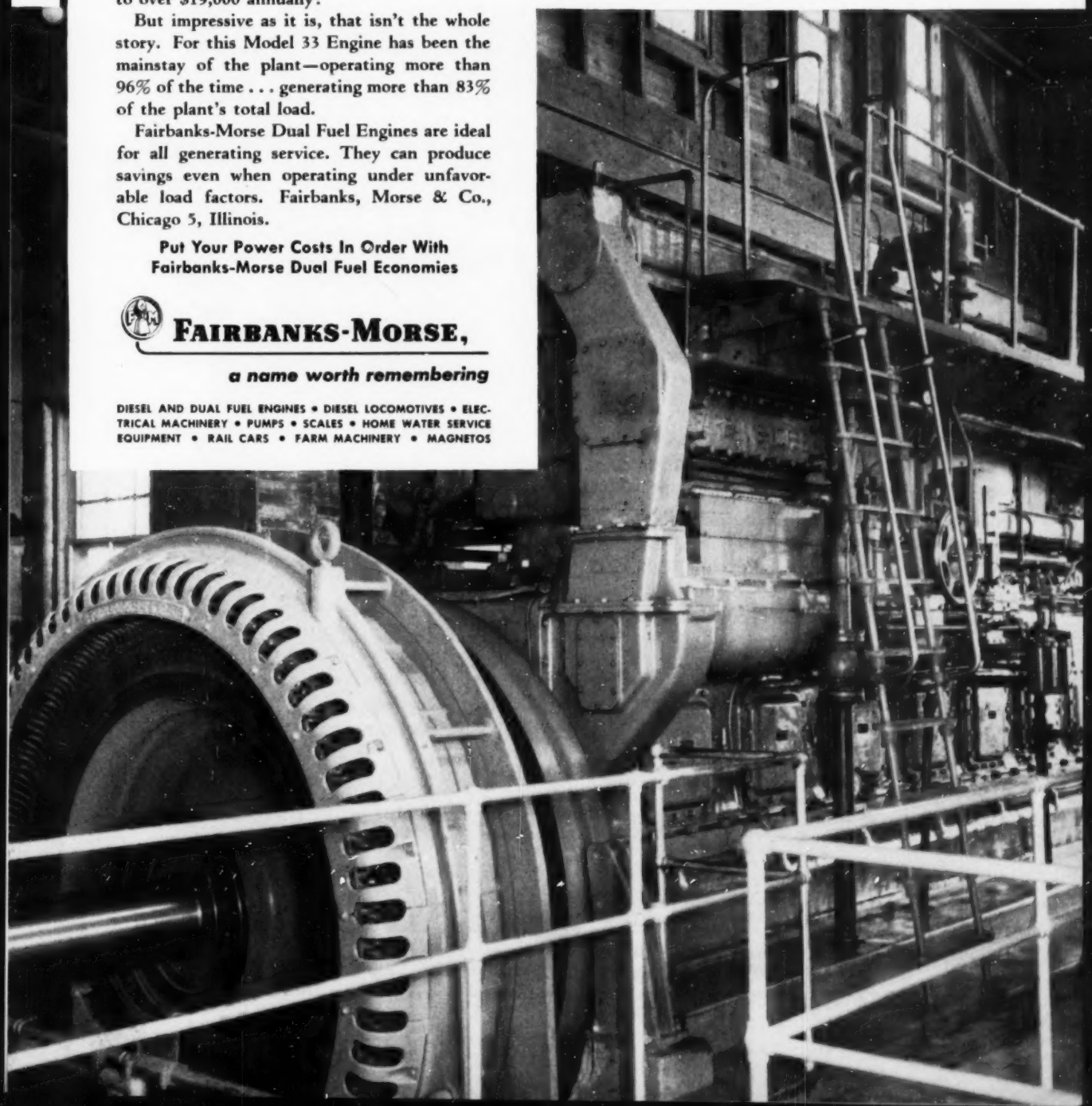
Fairbanks-Morse Dual Fuel Engines are ideal for all generating service. They can produce savings even when operating under unfavorable load factors. Fairbanks, Morse & Co., Chicago 5, Illinois.

Put Your Power Costs In Order With Fairbanks-Morse Dual Fuel Economies

FAIRBANKS-MORSE,

a name worth remembering

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS



the greatest savings in

DIESEL FUEL COSTS

are made by users of

THE SHARPLES CENTRIFUGE FOR CONTINUOUS PURIFICATION OF BUNKER OILS TO DIESEL FUEL REQUIREMENTS

With the current interest in burning heavy oils in diesel engines . . . the production records of users of Sharples Oil Purifiers give vital data on a purification procedure used for over 20 years in power plants on land and on sea.

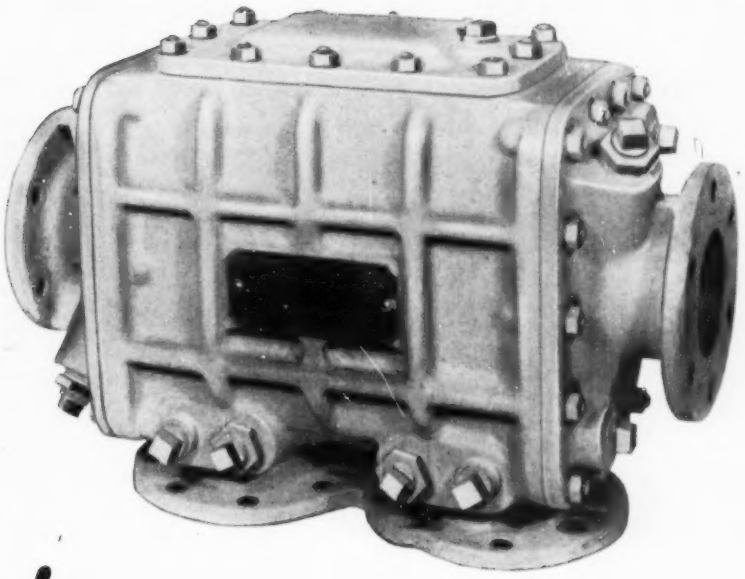
Briefly, the facts about the Sharples Oil Purifier are these: In one continuous operation, this centrifuge produces from low cost residual oils a diesel fuel that assures complete combustion; it applies the greatest continuous centrifugal force commercially available for the positive removal of all rust, carbon, tank scale and other solid impurities. Rings stay free; valves function properly; there is no cratering of injection nozzles. *Engines operate just as well as with more costly light diesel fuels.*

Only the Sharples Purifier performs this complete purification in a single, continuous performance that requires least operator attention. Owners report that the thousands of dollars saved annually on fuel costs alone quickly pay for the installation. These are the facts . . . it will pay you to investigate.

SHARPLES

THE SHARPLES CORPORATION • 2300 WESTMORELAND STREET, PHILADELPHIA 40, PENNA.

NEW YORK • BOSTON • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON



Efficient! Compact! Durable!

Diesel engine manufacturers have learned that they can depend on Harrison heat exchangers—oil coolers, water coolers—to do specific cooling jobs *right*. These men know that Harrison coolers combine high capacity with compactness—a combination that means much to designers and engineers.

Our years of designing and manufacturing heat transfer products of all types qualify us to be of service to you.

We welcome the opportunity to discuss your heat transfer requirements with you at any time.

HARRISON

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK

"Off Again--On Again"...

Fast work at each relay point helped a little. Every moment the rider could save made it easier for his relay string to keep up their Pony Express schedule. But profits for the contract rider lay in using only the best horses; those that could recover quickly and be fresh again for each run.

Otherwise, a corral full of extra mounts were needed. They ate up profits the way remachining of worn engine parts leads to higher Diesel operating costs.

That profit-destroying practice has been proved unnecessary. PORUS-KROME* and VANDERLOY M *renew* worn cylinder liners and crankshafts — make them recover with an actual gain in strength and endurance.

Liners renewed by Van der Horst have out-lasted as many as four new, unprocessed parts. Yet the cost of this long-lasting renewal is less than the price for *each* new, unprocessed replacement!

Why, then, keep a "corral full" of odd-sized Diesel parts? *All* of them — including those ready for scrap — can be restored to peak efficiency with PORUS-KROME and VANDERLOY M.

If you've been a little "on again, off again" about deciding to use Van der Horst processing, we invite you to ask us how the cumulative costs of remachining can be turned to dividends in your own Diesel operation.

* * *

**PORUS-KROME is a dense, hard, wear and corrosion-resistant chromium, produced by the Van der Horst Corporation of America, and which gives working surfaces an infinite number of tiny oil-retaining reservoirs for perfected lubrication.*

VAN DER HORST CORPORATION OF AMERICA
OLEAN, N. Y.

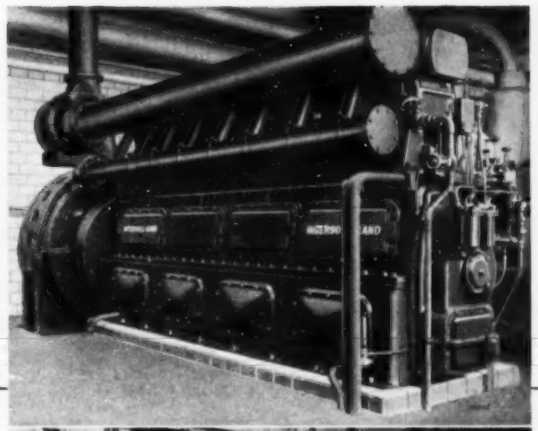
U. S. PATENTS 2,048,578, 2,314,604 and 2,412,698

DW-52E

PORUS - KROME VAN DER HORST

Heavy-Duty Diesels...

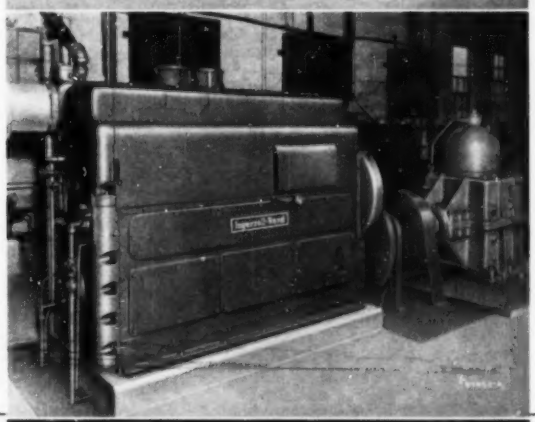
all designed for continuous full-load operation



An I-R 8 cylinder SS Diesel Engine driving a 600 kw generator in a factory.

The I-R type "S" is a 4-cycle, heavy-duty, medium-speed diesel engine with a fuel consumption of only 0.38 lbs per bhp-hr at full load. It has a bore of 10½ inches and a stroke of 12 inches. Speed is 720 rpm for driving 60-cycle generators and 750 rpm for 50-cycle and mechanical drive. It is available with 6, 7, or 8 in-line cylinders and rated at 450, 525 and 600 hp.

The type "SS" is a turbo-charged "S" and provides maximum economy of space and weight by producing more than 50 percent more power than unsupercharged engines. Available in 6, 7, and 8 sizes for 710, 825, and 945 hp.

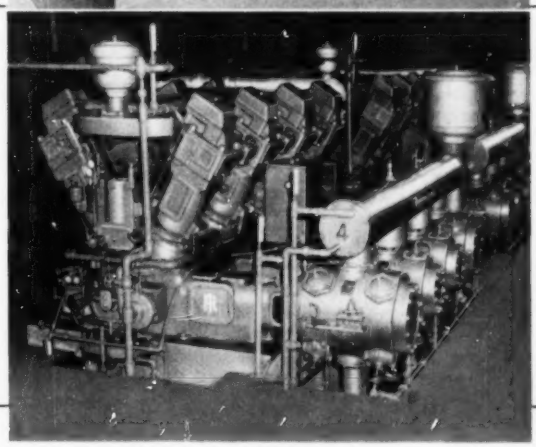


An Ingersoll-Rand 6 cylinder TS Diesel Engine driving an I-R vertical water pump through right-angle gears at a paper mill.

Ingersoll-Rand's new TS diesel engine is a smaller, lighter-weight engine built with all the longlife features, stamina and dependability of big engine design. It is 7 inch bore, 8½ inch stroke diesel with a fuel consumption of only 0.40 lbs per bhp-hr, but weighs about 30 lbs per hp.

Features include: big 5¼" crankshaft, full-floating aluminum-alloy bearings—full pressure lubrication, individual cylinder heads, replaceable liners, removable valve-seat inserts, large single-hole injection nozzles, gear-driven supercharger and many others.

Available with 6 or 8 in-line cylinders and delivering 200 to 375 continuous hp at 900-1000 rpm.



An I-R XVO Diesel-engine-driven air compressor with 8 power cylinders and 4 compressor cylinders on a construction project.

When a Diesel-powered compressor is needed, the Ingersoll-Rand "XVO" is the perfect answer; it combines a heavy-duty 4-cycle diesel engine and a heavy-duty, double-acting compressor in a single, compact machine that's easy to install and relocate. It assures a maximum compressed air output per pound of fuel. With one gallon of fuel oil, the XVO compresses 5600 cu ft of air to 100 lb pressure.

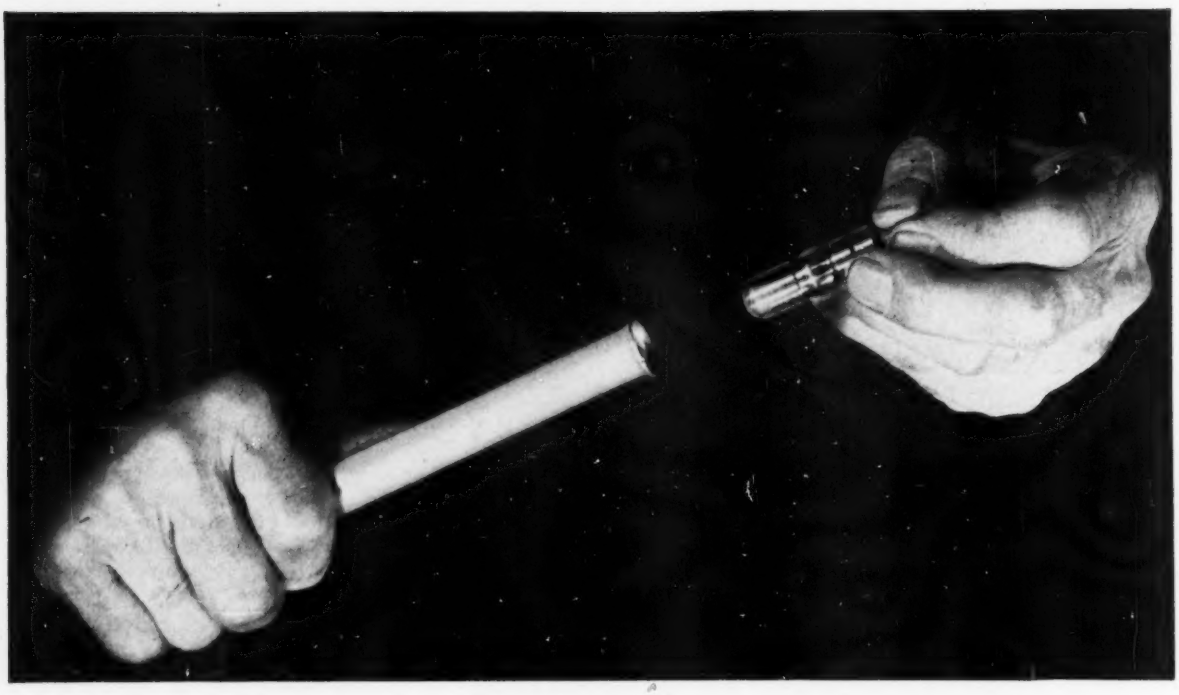
The XVO is available with compressor cylinders for any pressure or vacuum in four sizes with 2, 4, 6, or 8 diesel power cylinders rated at 66 to 280 hp.

Ingersoll-Rand

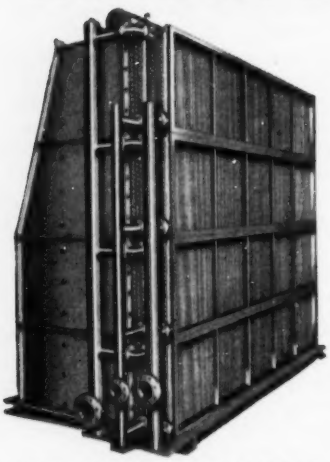
11 BROADWAY, NEW YORK 4, N. Y. 638-7

Starting Air Compressors • Hoists
Impactools • Starting Air Motors

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL & GAS ENGINES



The bullet that helps keep engines cool



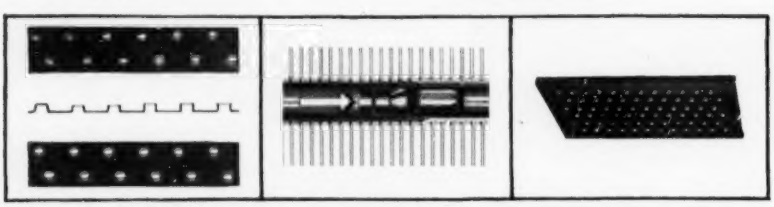
A TRANE Fluid Cooler typical of the hundreds that have been used to cool engine jacket water at the new Point Comfort Works of the Aluminum Company of America at Port La Vaca, Texas.

Secret of the high efficiency of TRANE Fluid Coolers for cooling engine jacket water and lube oil is a bullet. This bullet is shot through tubes in the final step in the creation of the core for the fluid cooler. It expands the tubes into the collars of the fins to form the exclusive TRANE mechanical bond. That bond is as permanent as the metals that form it and as strong as though fin and tube were one. There is no solder or brazing—heat transfer surface is smooth and uninterrupted. Through countless expansions and contractions the same high core efficiency is maintained. Thanks to the bullet and the bond it makes, the TRANE Fluid Cooler operates at high heat transfer efficiency over long periods of service.

The mechanical bond, however, is but one of many features of TRANE Fluid Coolers. Others include construction so rugged that units can be used for stationary or portable installations without additional bracing—mated fans and inlet orifice rings to assure low horsepower consumption—easy accessibility for quick cleaning and maintenance—adjustable pitch fans in larger units so that fan horsepower may be reduced when temperatures are lower.

The TRANE Fluid Cooler is available in 22 standard sizes to cover a wide variety of applications without special construction. They are finished with a weatherproof rubber base paint. A variety of drives can be used.

For more information concerning TRANE Fluid Coolers and the cooling of engine jacket water and lube oil, contact the TRANE sales office nearest you.



Built-In Precision—Collars on the fins used in the core of the fluid cooler are belled for accurate spacing and increased heat transfer efficiency.

Uniform Expansion—How the bullet expands the copper tube into the collars of the fin to form a perfect and lasting mechanical bond.

For Greater Strength—Heavy support plates strengthen and protect the coil—typical of the strength built into TRANE products.

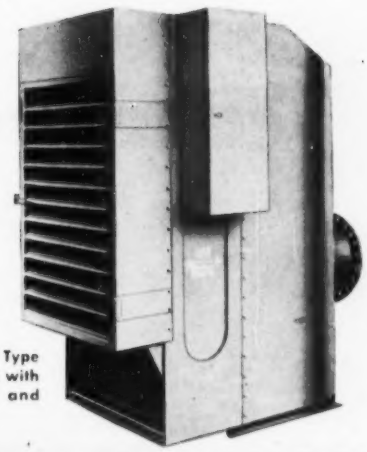
TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING, AIR CONDITIONING AND HEAT TRANSFER EQUIPMENT

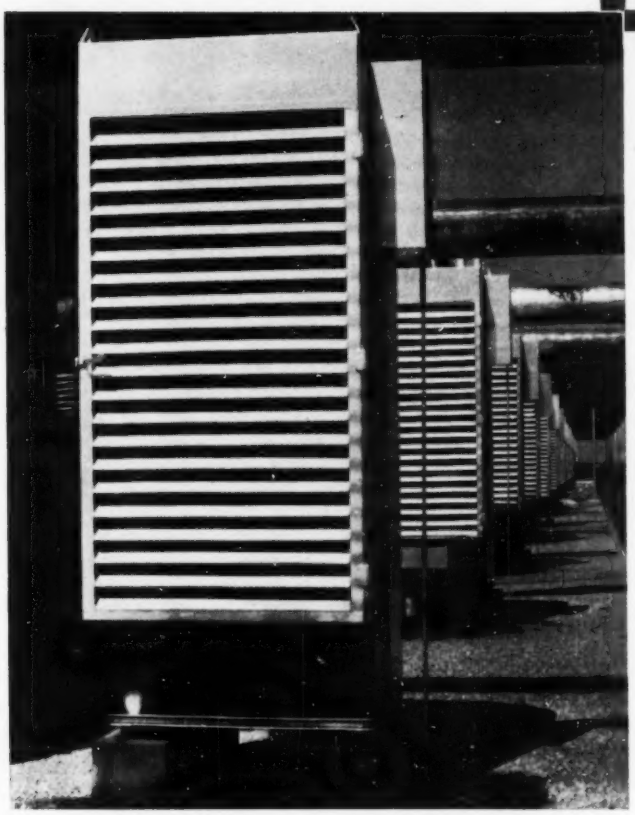
THE TRANE COMPANY, LA CROSSE, WISCONSIN
Eastern Mfg. Division . . . Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . . Toronto
OFFICES IN 80 U. S. AND 14 CANADIAN CITIES

A "MUST" Where There's Dust

Constant efficiency, uniform air delivery—AAF Multi-Duty Air Filters give you both automatically



Typical Multi-Duty Type CMS Filter equipped with weather louvers and plenum chamber.



Fifteen 2400 H. P. Cooper-Bessemer compressors make up this Hanford, Texas, unit of the Michigan-Wisconsin Pipe Line. Farsighted planning saw to it that dust protection was a part of the basic installation. Recognition of proven field performance resulted in the logical specification—AAF Multi-Duty Type CMS Air Filters.

The Type CMS washes its face regularly without the "mother care" of a maintenance man. Because cleaning of its overlapping panels is both automatic and continuous, high efficiency is maintained regardless of dust load, and uniform air delivery results at all times. Periodic inspection and regular sludge removal (without shutdown) are all that's required to keep this filter in fighting trim the year 'round.

For outdoor living, filters come equipped with protective weather louvers and a plenum chamber for attachment of intake. This chamber also has a perforated metal baffle which dampens intake pulsations and distributes air uniformly over the entire filter curtain area.

If you want to write off the threat of dust, permanently, write in the AAF Multi-Duty Type CMS in your next air filter specifications.

Write for Bulletin No. 150.

Today's Best Buy is Better Air!

AAF

American Air Filter

COMPANY, INC.

445 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

COAST TO COAST ON 5 GALLONS

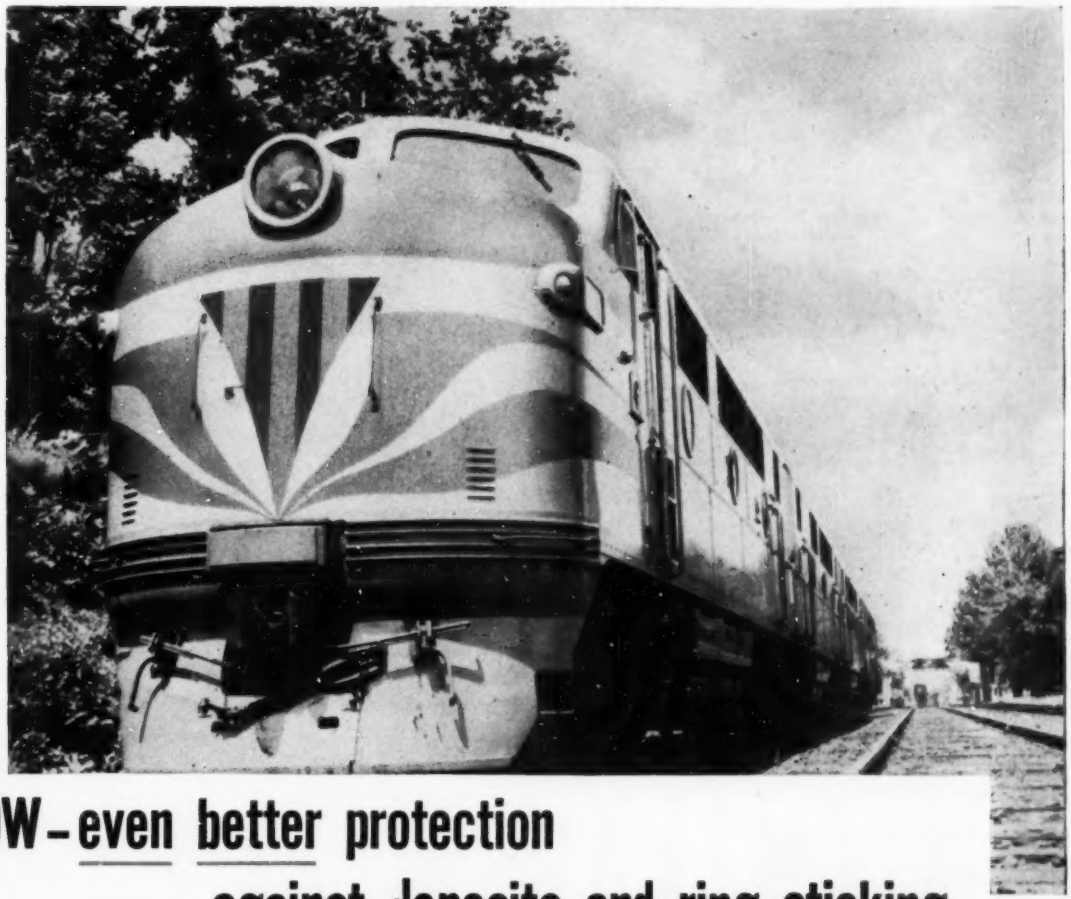
This five-gallon can of fuel oil will haul one ton of freight from New York to Los Angeles when used in a General Motors Diesel locomotive

An oil-burning steam locomotive would consume five times as much fuel on the same haul and would take 20% longer to get there.

TO CONSERVE FUEL AMERICA NEEDS MORE DIESELS!

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILLINOIS—*In Canada:* GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO

If you are interested in the conservation of fuel by Diesel locomotives, write Electro-Motive Division for a recent study



NOW – even better protection against deposits and ring sticking

the new, improved Gulf Dieselmotive Oil

Now—because of greatly improved detergent-dispersant characteristics, Gulf Dieselmotive Oil provides even better protection against harmful deposits in railway, marine, and stationary Diesels. It's ideal for engines with high power ratings and for use with fuels containing cracked materials or sulphur — keeps oil control and compression rings cleaner and freer. As a result, wear and oil consumption are kept remarkably low.

In all other respects, Gulf Dieselmotive Oil retains the same superiority demonstrated in millions of miles and thousands of hours of service. Made from 100% solvent-refined oil, it does not form harmful metal-like deposits on piston crowns, especially important where the same oil is in service for a long period of time.

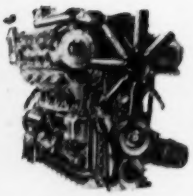
Containing an excellent oxidation inhibitor, Gulf Dieselmotive Oil has outstanding resistance to oxidation and the formation of crankcase sludge. And it's nonfoaming and noncorrosive to silver bearings.

These advantages add up to cleaner engines, reduced cylinder wear, and lower maintenance costs.

For further information, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

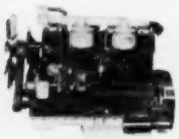
Gulf Oil Corporation · Gulf Refining Company
Pittsburgh 30, Pennsylvania

GULF

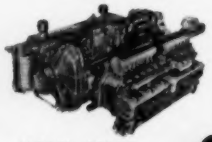


MODEL DNXV-8
Hercules 8 cylinder
Vee-Type Diesel Engine

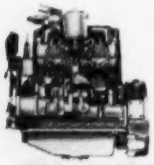
MODEL DIX6D
Hercules 6 cylinder
Diesel Engine



MODEL DFXH
Hercules 6 cylinder
Diesel Engine

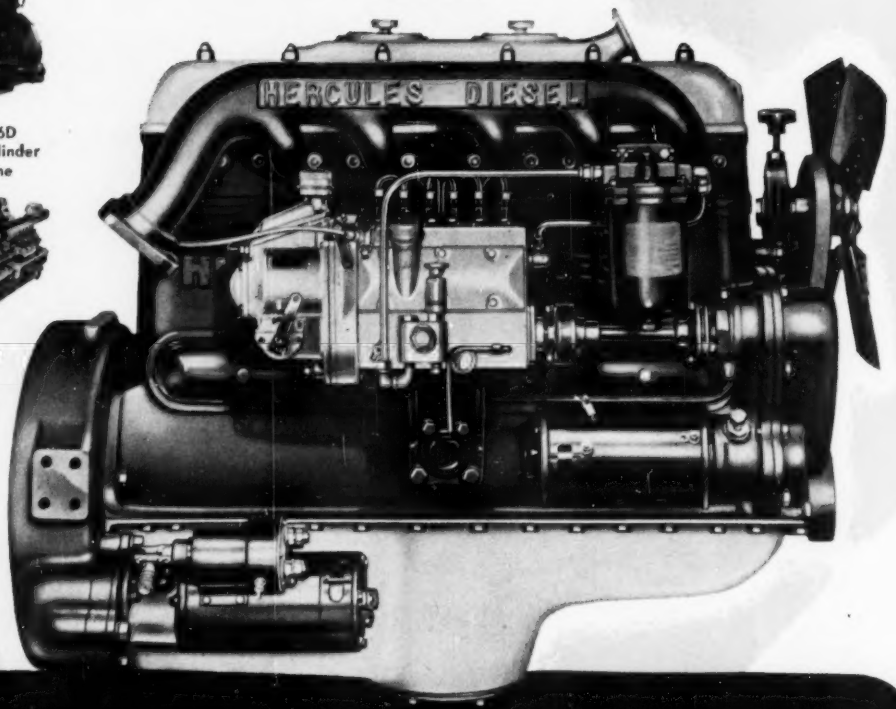


MODEL DFXHF
Hercules 6 cylinder
"Pancake" Type
Diesel Engine



MODEL DIX4D
Hercules 4 cylinder
Diesel Engine

MODEL DRX
Hercules 6 cylinder
Diesel Engine



HERCULES DIESELS

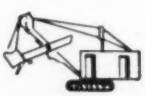
Model	Bore and Stroke Inches	Piston Displ. Cubic Inches
TWO CYLINDER DIESEL		
DIXC	4" x 4½"	113.1
DIXD	4¼" x 4½"	127.5
FOUR CYLINDER DIESEL		
DIX4B	3⅛" x 4"	133
DIX4D	3⅜" x 4"	166
DOOB	3¾" x 4½"	198.8
DOOC	4" x 4½"	226.2
DOOD	4¼" x 4½"	255
SIX CYLINDER DIESEL		
DIX6D	3⅜" x 4"	248
DJXB	3½" x 4½"	260
DJXC	3¾" x 4½"	298
DJXH	3¾" x 4½"	298
DJXHF	3¾" x 4½"	298
DWXC	4" x 4¾"	358
DWXCF	4" x 4¾"	358
DWXD	4¼" x 4¾"	404
DWXDF	4¼" x 4¾"	404
DWXLD	4¼" x 5"	426
DWXLDF	4¼" x 5"	426
DRXB	4⅜" x 5¼"	474
DRXC	4⅜" x 5¼"	529
DFXB	5" x 6"	707
DFXC	5¼" x 6"	779
DFXD	5½" x 6"	855
DFXE	5⅝" x 6"	895
DFXH	5¾" x 6"	935
DFXHF	5¾" x 6"	935
EIGHT CYLINDER DIESEL		
DNXV-8C	6" x 6"	1348
DNXV-8D	6¼" x 6"	1468
DNXV-8DS	6¼" x 6"	1468

designed for the job!

No matter how tough the task . . . you'll find a lightweight, high-speed HERCULES heavy-duty diesel to do the job and do it well!

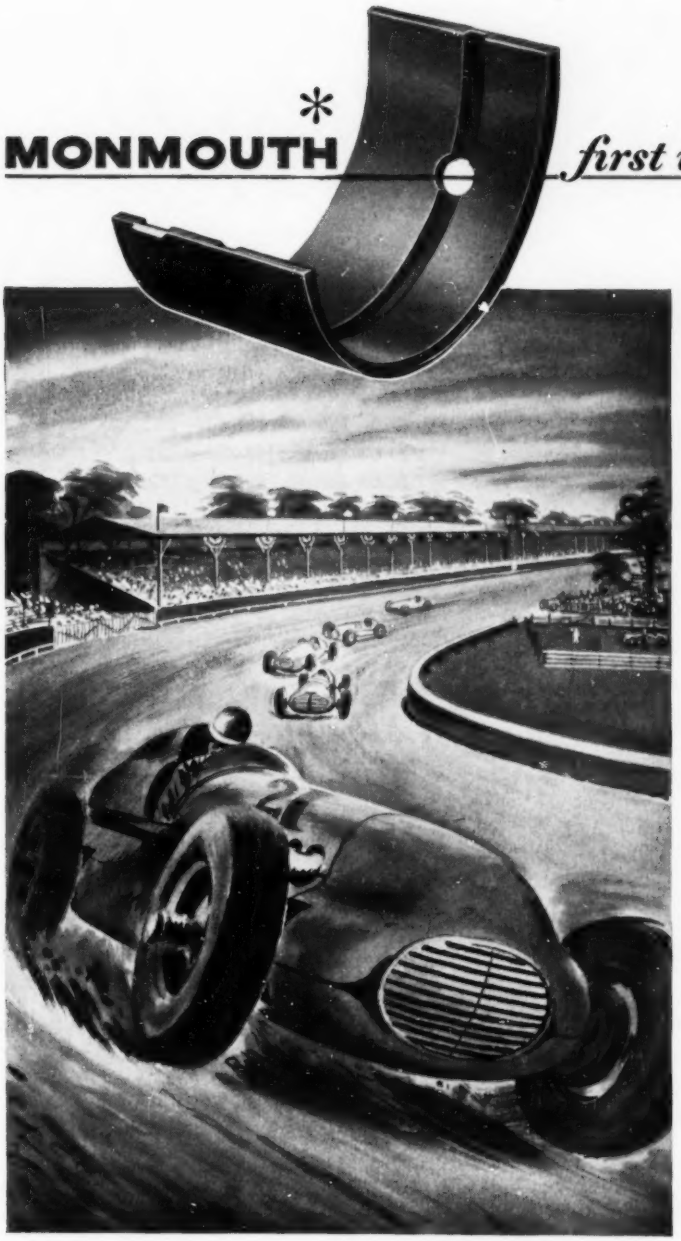
And, when it comes to continuous on-the-job performance...low per mile operating cost...maximum fuel economy...and minimum maintenance...you'll agree that Hercules Diesels are a profit-wise choice for dependable power.

On your future diesel power requirements, be sure you capitalize on all the advantages offered by the patented Hercules combustion chamber. 14 series and 29 models, ranging from 12 to 500 horsepower, offer unlimited power applications. It will pay you well to discuss diesel power with a Hercules engineer. No obligation, of course.



HERCULES MOTORS CORPORATION, *Canton, Ohio, U.S.A.*

MONMOUTH* *first with the finest*



The ABC's of CLEVITE* 77

ADVANCED DESIGN AND CONSTRUCTION

BETTER SURFACE ACTION

COMPARATIVE PERFORMANCE UNEXCELLED

CLEVITE 77's should be used only where engine manufacturers' specifications call for Clevite 77, that is, in those specific applications where engine characteristics, load and operating conditions require bearings with great fatigue resistance.

Truck and bus fleet operators, racing cars, contractors' heavy off-the-highway equipment require the kind of engine bearing performance that Clevite 77 alone can give.

For replacement use, Clevite 77's are sold under our Monmouth Brand. SPECIFY MONMOUTH!

*The words Monmouth, Clevite and Micro are registered trade marks of The Cleveland Graphite Bronze Co.

THE CLEVELAND GRAPHITE BRONZE CO.
REPLACEMENT SALES DIVISION
6545 Carnegie Ave. • Cleveland 3, Ohio

CGB FIRSTS: The development of continuous strip casting, 1929—thinwall babbitt lined steel-backed bushings, 1931—continuous casting of copper lead on steel strip, 1934—tri-metal bearings, 1938—Micro Bearings, 1959—Clevite 77, 1944—and others which have helped to revolutionize the lined bearing industry.

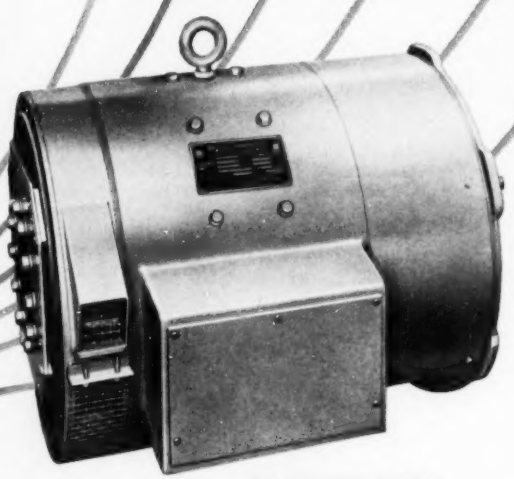
DEPENDABLE *Power*

DELCO GENERATORS

AC GENERATORS
20 KW through 150 KW at 1200 RPM
20 KW through 200 KW at 1800 RPM

Delco generators supply dependable power —where and when you need it. The power range of Delco generators for Diesel-driven stand-by and portable power plants is from 20 KW through 200 KW, AC and DC, 1500 and 1800 RPM.

When businesses such as hospitals, public buildings, factories, construction jobs, circuses and carnivals need independent power within these limits, the choice is frequently a Delco generator, Diesel-driven.



DELCO
DAYTON OHIO

DC GENERATORS
20 KW through 90 KW at 1800 RPM
20 KW through 75 KW at 1500 RPM
20 KW through 60 KW at 1200 RPM

DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco

HERE'S MORE HORSEPOWER TO YOU!

. . . with HAMILTON'S exclusive rotary exhaust valving

Sturdy unit construction gives the Hamilton rotary exhaust valve long life, easy maintenance.

Combustion is *better* because 40% more air is trapped in the cylinder . . . squeezed into the fuel spray cone as piston reaches top dead center.

●

You can burn *heavier* fuel oil.

●

Rating is the *same* on either diesel fuel or gas.

●

Exhaust is *cleaner, cooler* on the heaviest fuel.

●

You get MORE HORSEPOWER per cylinder size and speed than in any equivalent engine—without increase in pressure or in temperature.

Write for Bulletin 2151A951

Lima-Hamilton Division
Baldwin-Lima-Hamilton Corporation
Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

ANY WAY YOU LOOK AT IT...

NATIONAL D-E MAIN-GENERATOR BRUSHES
TRADE-MARK

COST LESS!

In the current drive for operating economy, don't overlook any of the *several* aspects of brush performance—and the way "NATIONAL" DIESEL ELECTRIC GENERATOR BRUSHES satisfy *every one of them*.

HERE'S HOW

- *Commutator Maintenance*—though necessarily a long-term evaluation—is first in economic and practical significance. "National" brushes have been proved *first* in preventing commutator wear, through successful service on more D-E locomotive generators than all other brushes combined!
- *Uniform Dependability* means freedom from breakage, shunt-loosening or any other brush failures. "National" brush grades are service-proved under all road conditions. Their exclusive construction and improved tamped-type connections protect against premature failures from any cause.
- *Efficiency—electrically,* "National" Main Generator Brushes carry peak loads and resist short-circuit currents and sparking. *Mechanically,* they are strong and low in friction. *Practically,* they lead the field in standardization and packaging for convenient installation, storage, and handling.
- *Brush Life,* the most obvious characteristic of brush performance—and an important one—is actually a function of those previously mentioned. A brush which maintains good commutator condition—one that is uniformly dependable and efficient—will *last longer* . . . as "National" D-E Main Generator Brushes DO!

Don't forget, either, the big economies of brush STANDARDIZATION—in which National Carbon Company leads the field. "NATIONAL" STANDARDIZED MAIN-GENERATOR BRUSHES ARE SHIPPED FROM STOCK AT THE SAME LOW PRICE FOR 100 or 100,000 brushes!

Standardized Brushes for D-E Locomotive Main Generators

NC NO.	DIMENSION	GRADE
NC 24-4009	2½ x 1¼ x ¾ (⅛-⅜)	SA-45
NC 24-4024	2½ x 1¼ x ¾ (⅛-⅜)	255
NC 12-4819	2¼ x 1½ x ⅜	SA-35
NC 12-4812 & 13	2¼ x 1½ x ⅜	SA-35
NC 13-5101	2¼ x 1.580 x .400	AX-5
NC 20-4202	2⁹⁄₁₆ x 1⁵⁄₁₆ x ⅜ (⁵⁄₁₆-⁷⁄₁₆)	SA-3590
NC 20-5633	2¼ x 1¾ x ⅜ (⁵⁄₁₆-⁷⁄₁₆)	SA-3590

ADD THEM UP! THEY TOTAL THE FINEST BRUSHES MONEY CAN BUY.

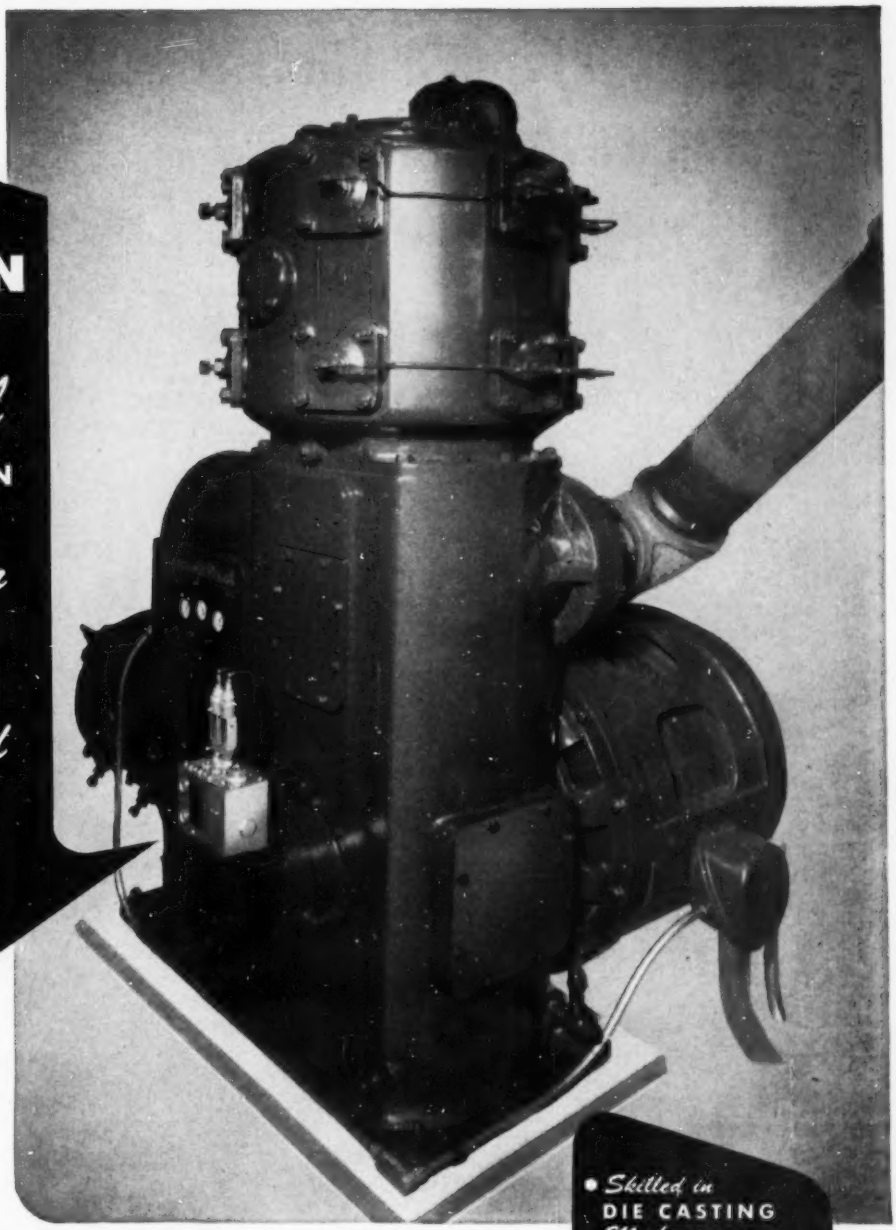
BUY NATIONAL STANDARDIZED BRUSHES FOR MOST EFFICIENT MOTOR AND GENERATOR OPERATION.

The term "National", the Three Pyramids device, and Silver Strand Cable device are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, New York
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
In Canada: National Carbon Limited, Montreal, Toronto, Winnipeg

MADISON -KIPP *fresh oil* LUBRICATION

fed under pressure by the measured drop!



Illustrated, the Madison-Kipp Model SVH Lubricator on an Ingersoll-Rand XLE Compressor.

- *Skilled in* DIE CASTING *Mechanics*
- *Originators of Really High Speed* AIR TOOLS
- *Experienced in* LUBRICATION *Engineering*

....STANDARD EQUIPMENT ON COMPRESSORS, WORK ENGINES AND MACHINE TOOLS....

Oil under pressure fed drop by drop from a Madison-Kipp Lubricator will definitely increase the production potential for years to come when applied as original equipment on new machine tools, work engines and compressors. There are six popular models for every application. Write for special engineering data for your particular requirement.

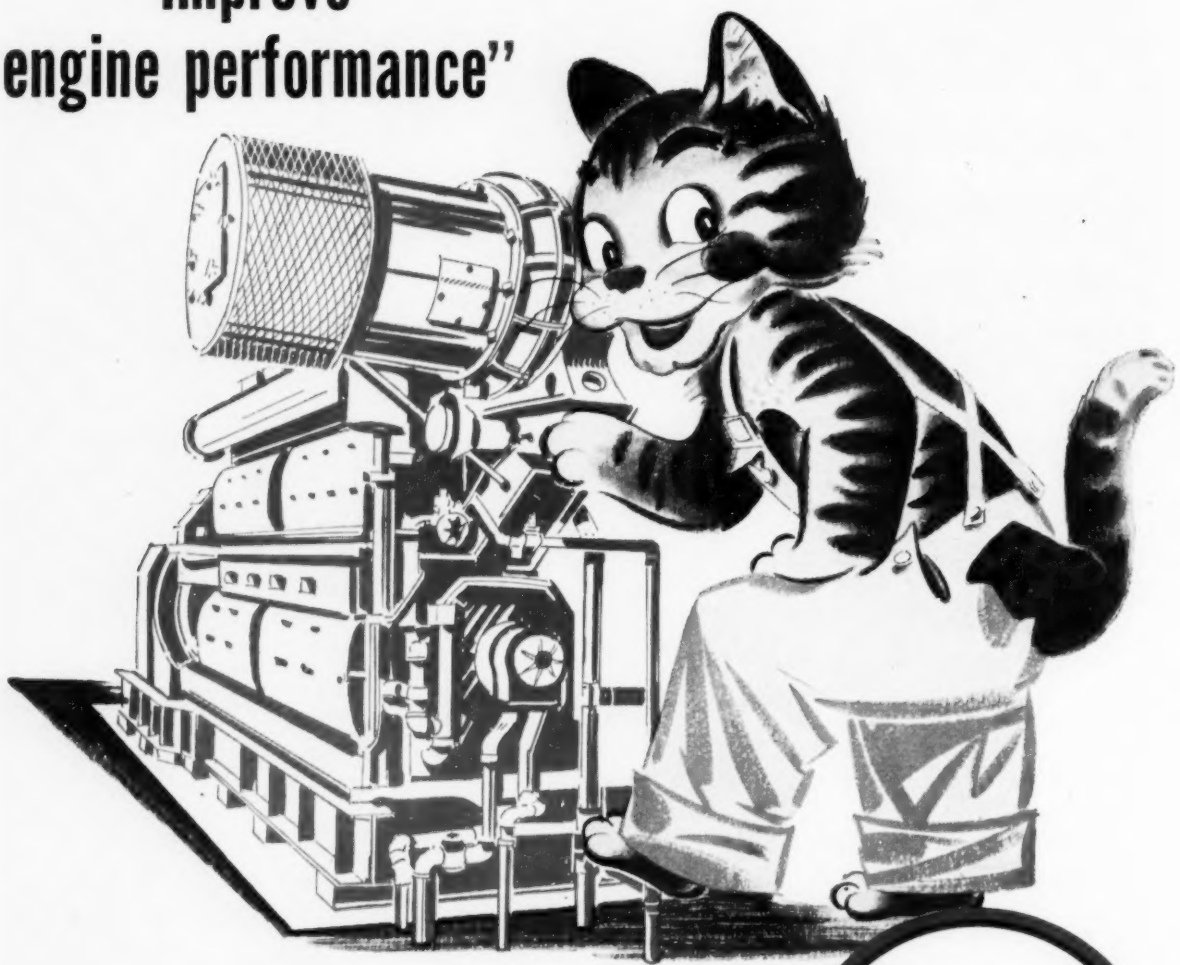
MADISON-KIPP CORPORATION

205 WAUBESA STREET, MADISON 10, WIS., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

"Tycol Diesel Oils assure free rings improve engine performance"



Certainly! Tycol Diesel Lubricants resist sludging, gumming and carbonization. They are made from specially refined, high quality bases, and offer outstanding stability. They have high resistance to heat and decomposition. They help diesels operate continuously . . . with maximum efficiency . . . and lowest maintenance costs.

There is a Tycol Diesel Oil scientifically engineered for every Diesel application – from high-speed units for industrial, railway and marine uses where a heavy-duty or detergent oil is necessary to low speed Diesels where a non-additive lubricant can be used.

Want to learn more about these fine oils – engineered to do the job better, at lower cost? Call or write your nearest Tide Water Associated office today.

TYCOL

INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
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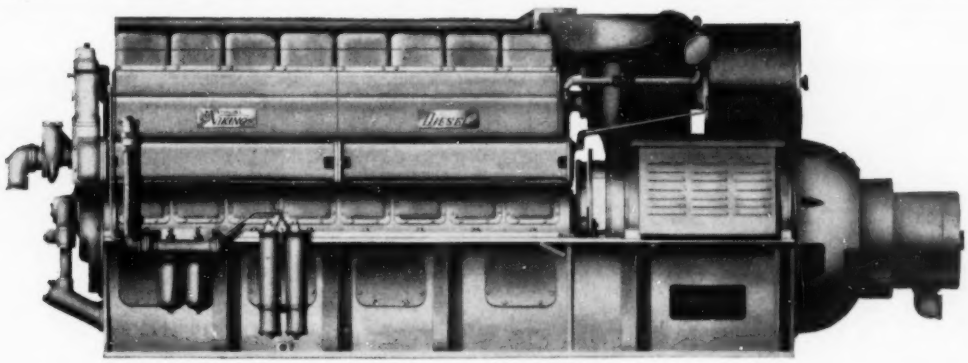
TIDE WATER ASSOCIATED OIL COMPANY

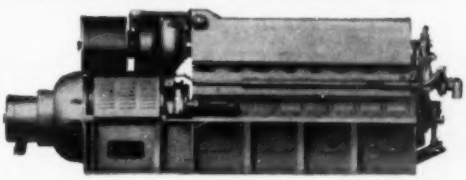
17 BATTERY PLACE · NEW YORK 4, N. Y.

SEND FOR A FREE COPY OF "TIDE WATER ASSOCIATED LUBRICANIA"

Sterling Viking Diesels definitely lower costs of power production



Model VDS-8S, 600 KW Generator Set. Viking Diesel "packaged unit" generator sets are available in 6 and 8 cylinder models. Bulletins 1024 and 1028 contain sectional views, fuel consumption curves, engineering and installation details. Sent on request.



We have the evidenced facts to show any user of diesel electric generator sets that the newly engineered Sterling Vikings can cut KW hour production costs by as much as 50 per cent.

Fuel consumption, engine weight, compactness, housing, installation, parts cost, general maintenance — all are factors in the service worth of a generator set. On every point Vikings offer proven advantages confirmed by comparison. In diesel engineering, Sterling has come up with design developments that have the industry talking. We would like to give you this story of lower power costs first hand. Write us for latest Sterling Viking Diesel literature.

Sterling

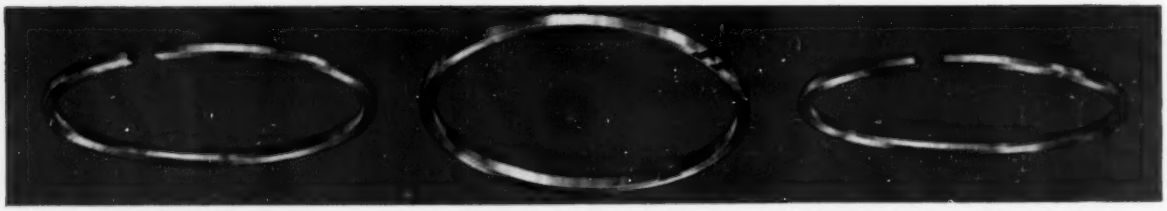
MARINE AND INDUSTRIAL

ENGINES

● Depend upon Sterling Diesel Power for Locomotives, Generator Sets, Commercial and Fishing Craft, Lift Bridges, Ventilating Systems, Drilling Rigs, Etc.

Diesel, Gasoline, Gas—4, 6 and 8 cylinder—30 HP to 1,000 HP

STERLING ENGINE COMPANY • 1270 Niagara Street • Telephone Lincoln 0382 • Buffalo 13, New York



Koppers K-Spun Rings

Manufactured in diameters up to 12½" by Koppers exclusive centrifugal casting process. 100% stronger, 4 times more resistant to combustion shock than ordinary rings. Will not break in installation or for the life of the engine. For high-speed diesels and other applications where extreme strength is needed.

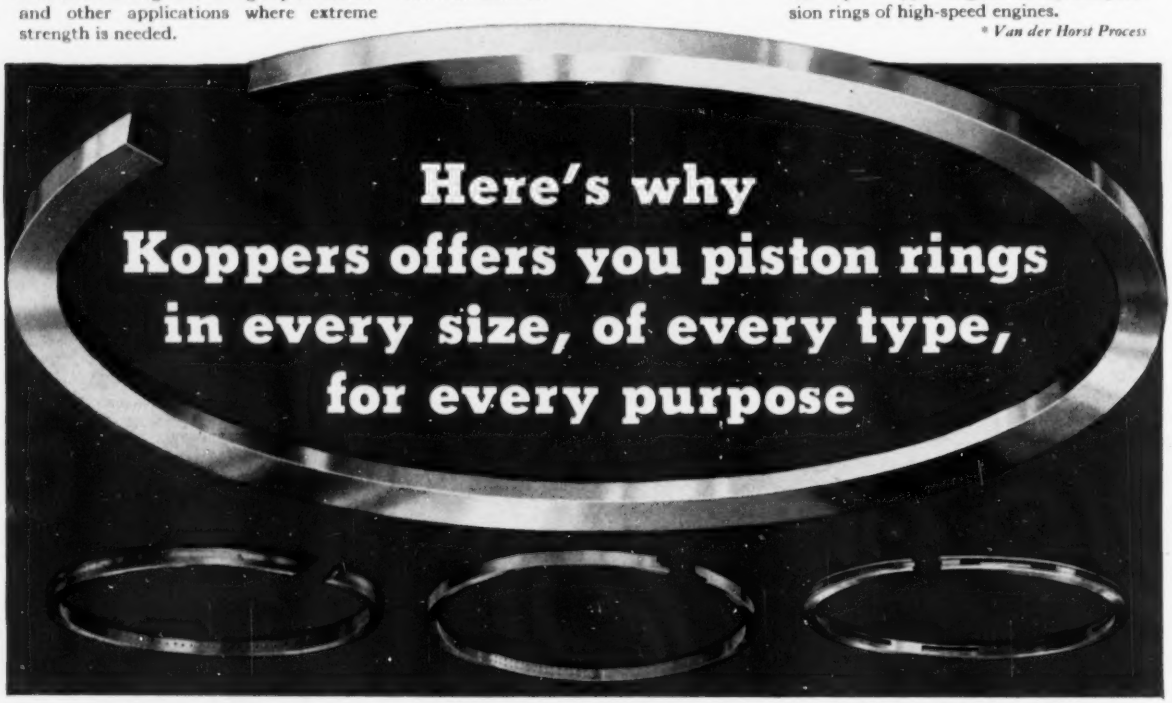
Koppers Lug Seal Rings

A specially designed two-piece ring for use on badly out-of-round and tapered cylinders, or on pistons with worn grooves. Maintains compression at a high level, prevents blow-by, provides highly efficient oil control.

Koppers Porous Chrome* Rings

Porous Chrome surface holds and distributes oil during break-in, quickly wears to perfect seating. Combined with K-Spun metal in sizes up to 12½" dia. Last up to 4 times as long as other rings, cut cylinder wear up to 50%. Designed for top compression rings of high-speed engines.

** Van der Horst Process*



Koppers Seal Rings

Specially designed ring with a projecting bronze band that causes a burnishing action on cylinder walls. Decreases scuffing and wear on cylinder walls of gas and diesel engines, air and refrigeration compressors and many other applications.

Koppers Step-Seal Rings

Designed especially for applications where blow-by is a serious problem. Combines the strength of a single-piece ring with the sealing qualities of a multiple-piece ring. For use on hydraulic presses and diesel and other internal combustion engines.

Koppers Oil-Cutter Rings

Exceptional oil control is attained by unique design . . . 2 bevels for riding over oil on upstroke, 2 scraping edges for taking excess oil from cylinder walls on downstroke, plus a series of wide drainage slots. For use on high-speed, 4-cycle engines.

These are a few of the hundreds of rings manufactured by Koppers.

EVERY piece of equipment presents a different piston ring problem. Koppers, with its wide variety of rings for every conceivable use, provides the solution to *all* industrial and automotive ring problems.

Our engineers, who work with you in determining the best rings for your applications, have all the facilities of the large, modern Koppers piston ring plant at their disposal . . . to supply you with the rings that will cut down-time, increase efficiency and lengthen the life of your equipment.

No matter what kind of equipment you have . . . railroad, stationary or marine diesels, aircraft or automotive engines, pumps, compressors, steam hammers, hydraulic presses . . . if it uses piston rings or sealing rings, write, wire or phone us today for experienced help with your piston ring problems. Koppers Company, Inc., Piston Ring Dept., 1544 Hamburg St., Baltimore 3, Maryland.

KOPPERS®

KOPPERS *Only KOPPERS can furnish K-Spun or Porous Chrome!*

AMERICAN HAMMERED **PISTON RINGS**

Cylinder bore wear REDUCED . . 84.6%

Main bearing wear REDUCED . . 77.9%

Rod bearing wear REDUCED . . . 93.3%

Piston wear REDUCED 78.4%

with

PUROLATOR

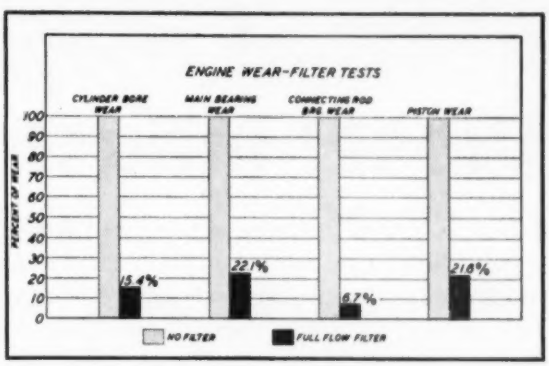
FULL-FLOW

MICRONIC FILTERS

THESE ARE THE RESULTS of tests just completed by one of the world's largest automobile and engine manufacturers.

The purpose of these tests was to determine how much the Micronic Full-Flow element reduces wear.

Running standard gasoline engines under extremely adverse conditions, test engineers found that Purolator Micronic* Full-Flow filtration was the best of all tried . . . far superior to any partial-flow filter.



The secret of this amazing performance is the Purolator* *Micronic* Filter Element with *ten times* the filtering area of old-style filters. It is the *only* element capable of delivering full-flow rates during its entire service life, with effective, dependable filtration down to *microns* (0.000039 in.)!

Purolator's Engineering Department will gladly cooperate in helping you adapt super-efficient Purolator Micronic Full-Flow filtration to your own requirements. *Just write!*

*Reg. U. S. Pat. Off.

PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices:
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PUROLATOR
MICRONIC OIL FILTER
"FIRST IN THE FIELD OF FILTERING"

Eaton Parts for Diesel Engines

have a background of years of cooperation with the Diesel industry

Eaton is proud to have served as supplier to leading Diesel engine manufacturers for many years—furnishing valves, free-valves, lash adjusters, valve seat inserts, cam followers, bolts, studs, and other precision parts. This close cooperation with the Diesel industry has given Eaton engineers a thorough understanding of the requirements of specific engines, so essential in solving valve-train and other problems.

You can utilize Eaton's long experience in this field by giving our engineers an opportunity to work with yours in the early stages of design.

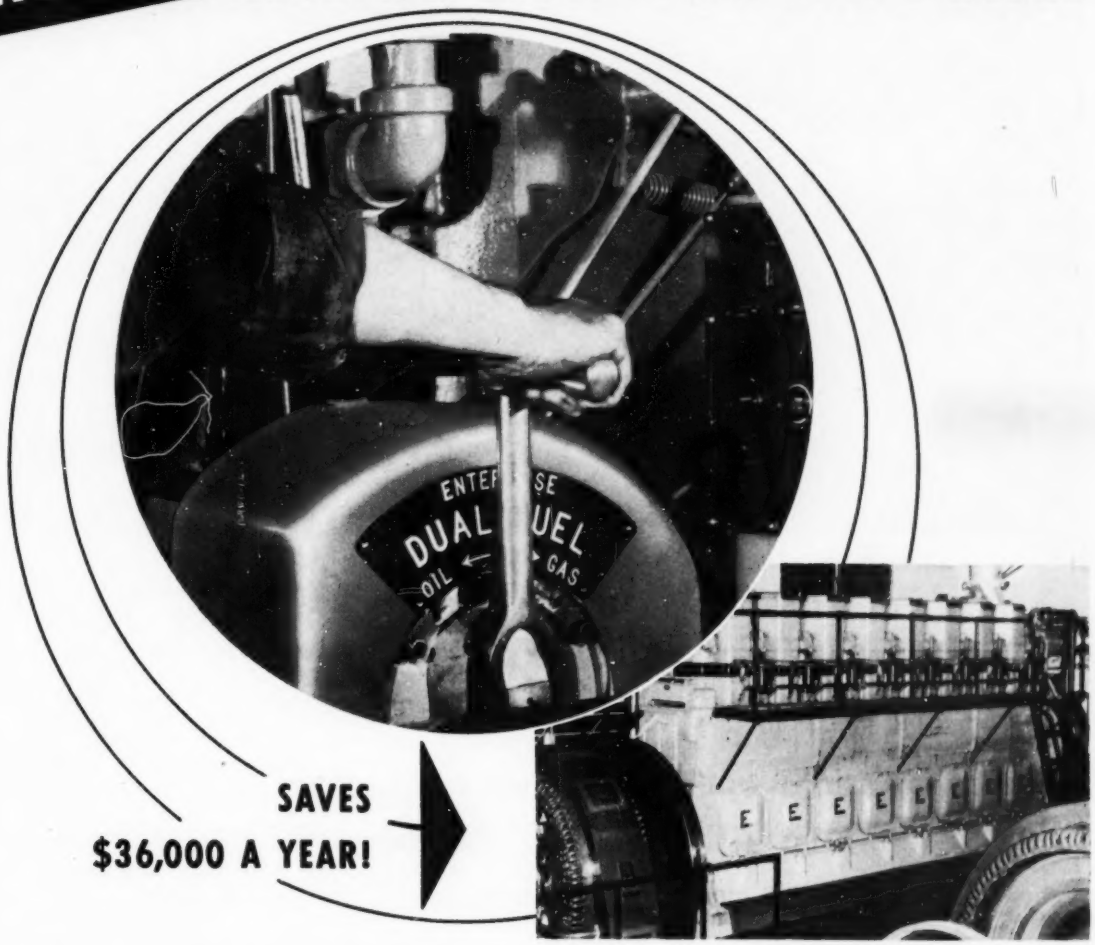
EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

SAGINAW DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

PROVED ENTERPRISE *Dual Fuel* Power



SAVES $36,000 A YEAR!

Two Enterprise Dual Fuel Units are now in service at the Municipal Utilities plant in Broken Bow, Nebraska. Their combined capacities of 1800 KW more than doubles the capacity of the three straight diesels formerly in operation—*at an estimated saving of $36,000 per year in fuel costs alone!*

Wherever natural or sewage gas is available in sufficient quantities, Enterprise DUAL-FUEL engines provide a maximum operating efficiency at greatly reduced fuel costs.

Initial selection of operating fuel is manual, with smooth and positive changeover from one fuel to the other simplified through Enterprise single-lever control.

Any fluctuation in gas pressure is compensated for automatically by a corresponding increase or decrease of the gas-fuel ratio, thereby *maintaining constant engine speed and load.*

Get full details on quality-built cost-saving Enterprise DUAL-FUEL engines today. Models from 68 to 1755 BHP per unit, generator sets to 1250 KW, turbocharged or normally aspirated.

Enterprise
DEPENDABLE
Diesels

ENTERPRISE ENGINE & MACHINERY CO.
A Subsidiary of General Metals Corporation
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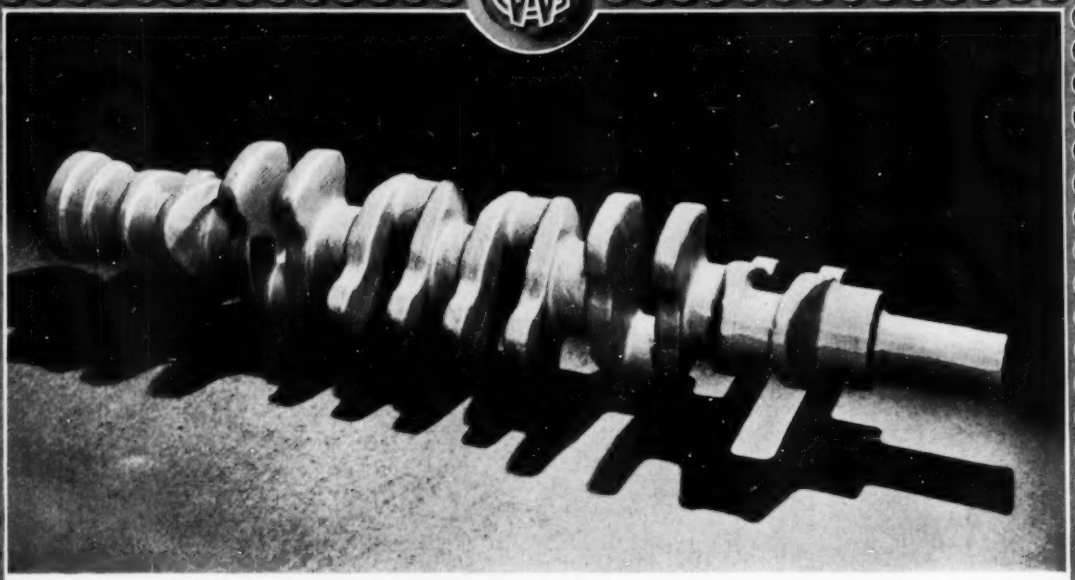
BOSTON • CHICAGO • FT. WORTH • KANSAS CITY • LOS ANGELES • NEW ORLEANS • NEW YORK • SEATTLE • ST. LOUIS • WASHINGTON, D. C.



Diesel Power has become a major factor in the truck and tractor field. Here again Wyman-Gordon crankshafts are the standard of the industry.

Crankshaft Specialists since the birth of the internal combustion engine and today the largest producer of crankshaft forgings, Wyman-Gordon furnishes die forged cranks of all types and in weights up to a thousand pounds.

Standard of the Industry for More Than Sixty Years

WYMAN-GORDON

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL

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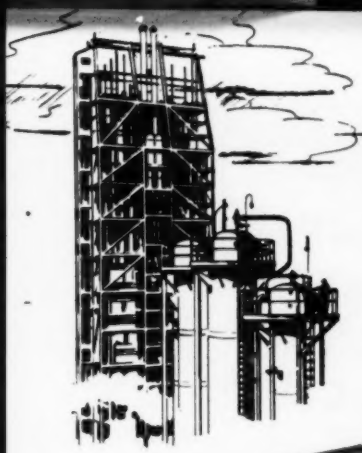
HARVEY, ILLINOIS DETROIT, MICHIGAN



Carefully Refined

to meet rigid specifications of diesel engine manufacturers

Ashland special DIESEL *fuels and lubricants*

Our modern refineries, including several catalytic plants, assure you the finest fuels and lubricants.

In every case where engine manufacturers have established specifications, we have equalled or bettered their requirements for that particular grade of fuel. Not only can we meet these requirements, but rigid controls over every refining operation assure that each shipment received adheres to these specifications. You can depend on Ashland diesel fuels for the same day-in, day-out operating efficiency.

Ashland also offers a complete line of tested lubricants. These include the well-known VALVOLINE and ENARCO brands which many operators of diesel equipment consider the finest in the field.

...complete line of lubricants for diesel equipment

ASHLAND OIL & REFINING COMPANY

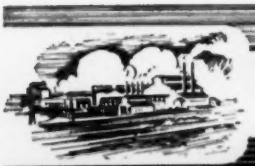
ASHLAND, KENTUCKY

SUPPLY TERMINALS: Ashland, Ky. — Buffalo, N. Y. — Canton, O. — Cincinnati, O. — Cleveland, O. — Erie, Pa. — Evansville, Ind. Findlay, O. — Follansbee, W. Va. — Freedom, Pa. — Kenova, W. Va. — Kobuta, Pa. — Louisville, Ky. — Marietta, O. — Nashville, Tenn. — Niles, O. — Paducah, Ky. — Pittsburgh, Pa. — St. Elmo, Ill. — St. Louis, Mo. — Toledo, O.

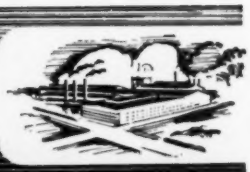
An Unusual Combination—

PRECISION CRAFTSMANSHIP *In* VOLUME PRODUCTION!

HERE at Erie Forge we like to call ourselves specialists . . . specialists in precision forging and machining. We believe in "One Control—One Responsibility". Here under one roof we control every step in the production of the finished product from the raw material to the finished crank. Design, metallurgical control, casting, heat treating, forging and machining are under the watchful supervision of fine craftsmen with many years of experience. Consult with us on your next requirements for crankshafts, connecting rods or allied items.



ERIE FORGE & STEEL CORPORATION
ERIE, PENNSYLVANIA



Cummins® Diesels
do so many jobs-so much better

Shovels, cranes, industrial locomotives

Drilling rigs, centrifugal pumps, generator sets

Buses and on-highway trucks

...because they're custom-built to fit the job

Earthmovers, logging yarders and loaders

Off-highway trucks, crawler tractors

Work boats, pleasure craft

Lightweight, high-speed Diesels (50-550 hp) for these and many other uses

---

...because they're

BUILT NOT ONCE BUT TWICE

Rugged, lightweight, high-speed Cummins Diesels are at work everywhere. Each engine is built *twice*. It's assembled, run-in tested, disassembled and inspected, then reassembled and tested again. This extra care in building, plus Cummins exclusive fuel system and an efficient and expanding service and parts organization, means minimum "down time", more power and profits for the user. See your Cummins dealer.

CUMMINS Dependable DIESEL

TRADEMARK REG. U. S. PAT. OFF.

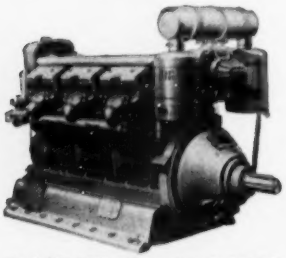
Diesel power by CUMMINS

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

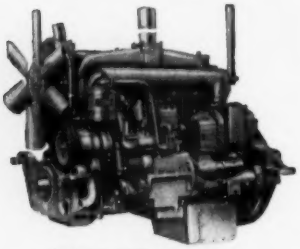
Export: Cummins Diesel Export Corporation • Columbus, Indiana, U.S.A. • Cable: Cumdiex

SOME *Famous* ENGINES EQUIPPED WITH SCHWITZER-CUMMINS SUPERCHARGERS

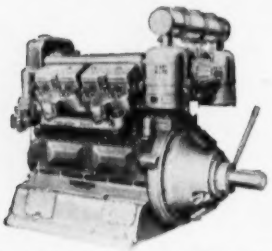
Model 687-C—Harnischfeger Corporation 6 cylinder, 2 cycle using two S-C superchargers.



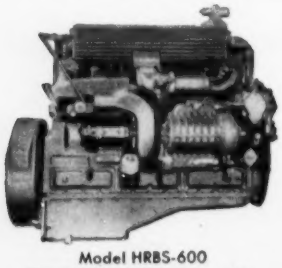
Model D-397—Caterpillar Industrial Diesel V-12.



Model D-337—6 cylinder—Caterpillar Diesel.



Model D-375—Caterpillar Diesel V8.



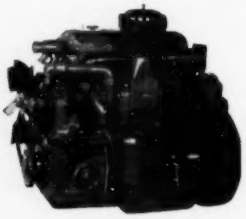
Model HRBS-600
Cummins Engine Company, Inc.
(Used also on HBS Series)

More than twenty-five years of research, intensive engineering, wide field experience and unexcelled manufacturing facilities are back of our product.

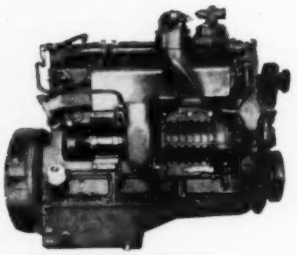
Its excellent service record in tens of thousands of applications under the most severe operating conditions has established Schwitzer-Cummins superchargers as a product of supreme reliability and efficiency.

We build superchargers for trucks, busses, earth-moving equipment, power plants, submarines, in fact for all uses up to 800 hp.

We can offer the last word in engineering assistance and the ability to produce efficiently.

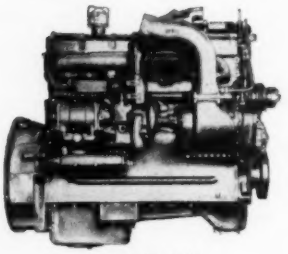


Model 487-C—Harnischfeger Corporation
4 cylinder, 2 cycle.



Model NHRBS-600
Cummins Engine Company, Inc.
(Used also on NHS-NHBS-NHBRS.)

SCHWITZER-CUMMINS
Also
Supercharges Engines
for
MACK-INTERNATIONAL,
INGERSOLL-RAND
AND OTHERS



Model JBS-600
Cummins Engine Company, Inc.
New High Speed Engine.

Other Schwitzer-Cummins Products

- **OIL PUMPS**
- **WATER PUMPS**
- **COOLING FANS**
- **VIBRATION DAMPERS**
- **AUTOMATIC SHAFT SEALS**

SUPERCHARGER SPECIALISTS FOR OVER 25 YEARS

SCHWITZER-CUMMINS COMPANY
1125 MASSACHUSETTS AVE. · INDIANAPOLIS 7, INDIANA

For proven dependability...

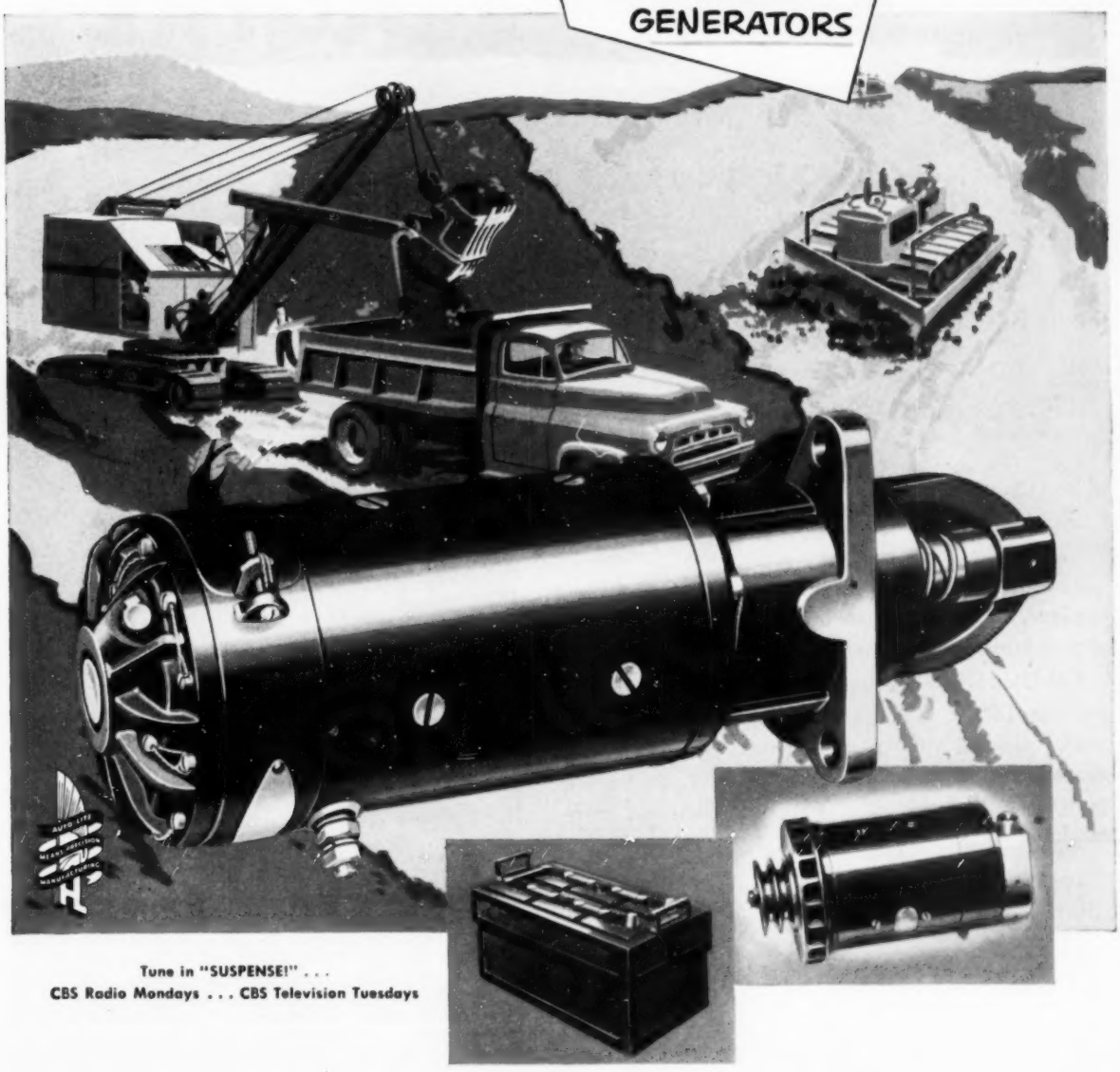
AUTO-LITE

diesel equipment

For over 41 years Auto-Lite has been building complete electrical systems for the makers of many of America's finest cars, trucks and tractors. It is this experience that makes possible the outstanding dependability achieved in Auto-Lite Diesel Equipment—from generators to voltage controls—from batteries to starters. This unfailing reliability in service has helped to make Auto-Lite the world's largest independent manufacturer of automotive electrical equipment. If you have a particular diesel problem, Auto-Lite invites you to write to

THE ELECTRIC AUTO-LITE COMPANY
Toledo 1, Ohio — Sarnia, Ontario

STARTERS
BATTERIES
GENERATORS



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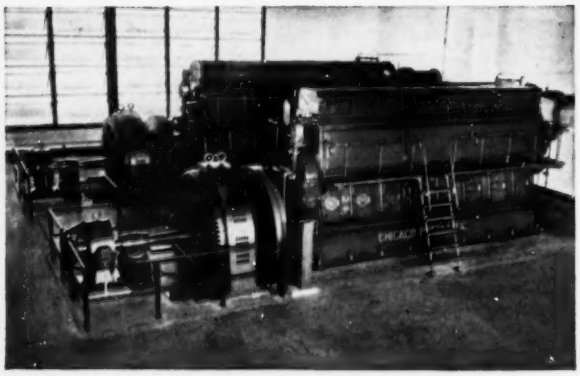
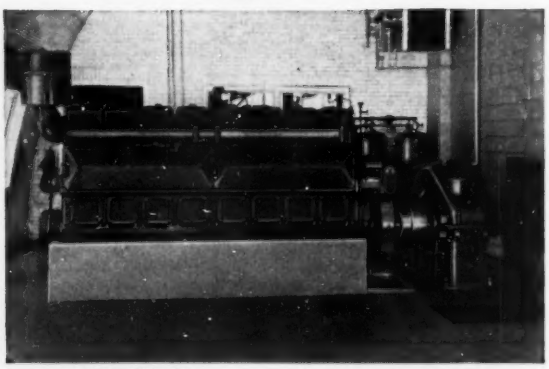


Two CP 1500 H.P. Diesels in a western public utility station.

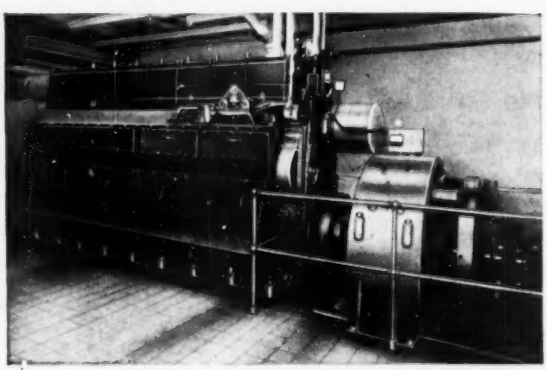
CP 1650 H.P. 8-cylinder Diesel in well known industrial plant.



CP 400 H.P. Diesel in petroleum pipeline station.

Available in sizes ranging from 120 H.P. to 1750 H.P., these engines can be furnished either for straight Diesel or for Dual Fuel operation. The CP line includes both normally aspirated and supercharged engines, all the latter incorporating the thoroughly dependable Elliott Turbocharger.

CP Diesels have proved profitable investments for public utilities; industrial, municipal, ice and waterworks plants; and in mining, oil, pipeline, cotton ginning and other fields where low cost, dependable power is a vital necessity. Write for complete information.



CP 640 H.P. Diesel in large laundry.

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American Flexible Metal Hose for exhaust or air intake—marine or industrial diesels – is available in two general types: Corrugated Steel, Type B, illustrated at left; and Interlocked Steel, shown at extreme right. Flanges are available to ASA standards or various navy specifications. For details, write The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd. 51254

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Manufacturers of diesels rely upon Ellwood City Forge for their most exacting requirements. We never disappoint them.

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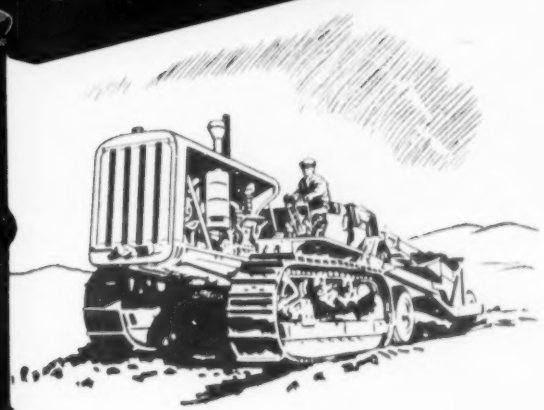

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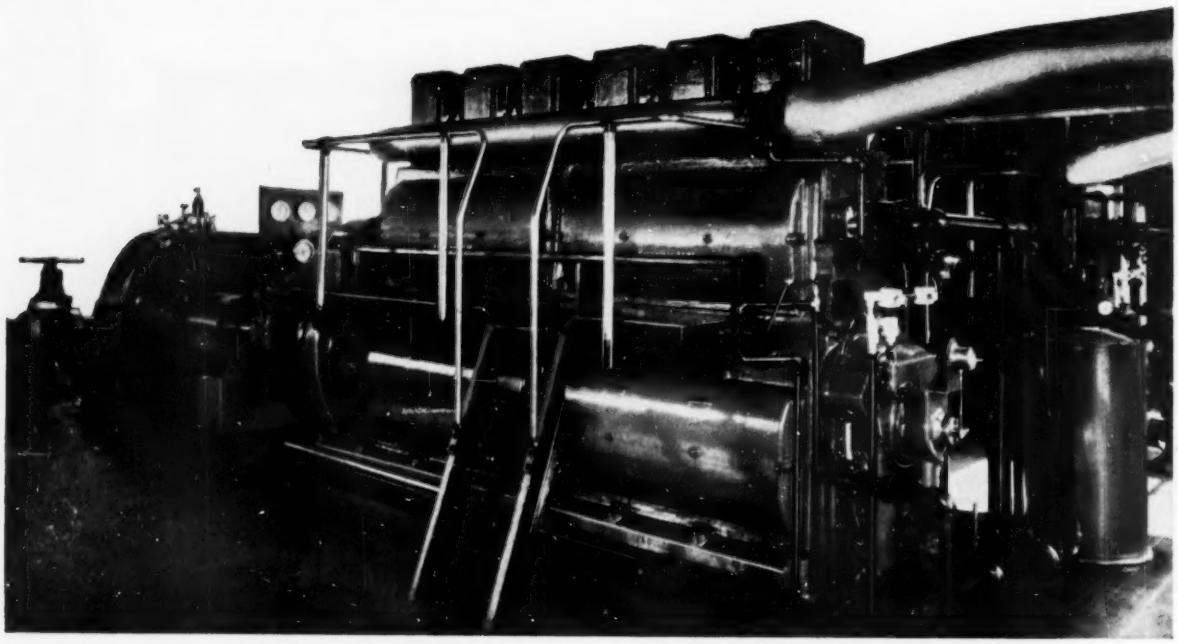
at the Anthony Station of Magnolia Pipe Line . . .



89.6% of elapsed time

for 11 years . . . that's Alco dependability

On-the-job performance—the toughest test of all shows what Alco Standardized Diesels can do. Two of these engines installed at the Anthony Station of the Magnolia Pipe Line have each rolled up over 90,000 hours of operation since installation. They have run as much as 94.9% of the elapsed time in a single year.

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- **Compactness** for lower construction costs
- **Higher engine efficiency** for lower fuel costs
- **Medium speed** for lower auxiliary equipment costs
- **Flexible power range** for lower expansion costs

In the last ten years *more Alco Diesel Engines have been installed in oil pipe line pumping service in the United States and Canada, than any others.* To find out how they can help you, contact your nearest American Locomotive Company Sales Office at Beaumont, Chicago, Cleveland, Houston, Kansas City, New York, San Francisco, Schenectady or St. Louis.

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TOCCO* and the Diesel Industry Progress *Together*

● In the manufacture of many Diesel engine and accessory parts TOCCO Induction Heating has proved a sound method of increasing product quality, speeding production and lowering unit costs. TOCCO-hardening of vital parts prevents wear, insures 5 to 10 times longer life—with consequent customer satisfaction.

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Hercules Motors Corp.
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April, 1952

Vol. 30, No. 3

Cover Photo: Five Euclid dump trucks and Bucyrus-Erie crane, all Cummins-powered, working at Folsom Dam, Sacramento, California. Contractor G. F. Atkinson, San Francisco, owns the equipment.

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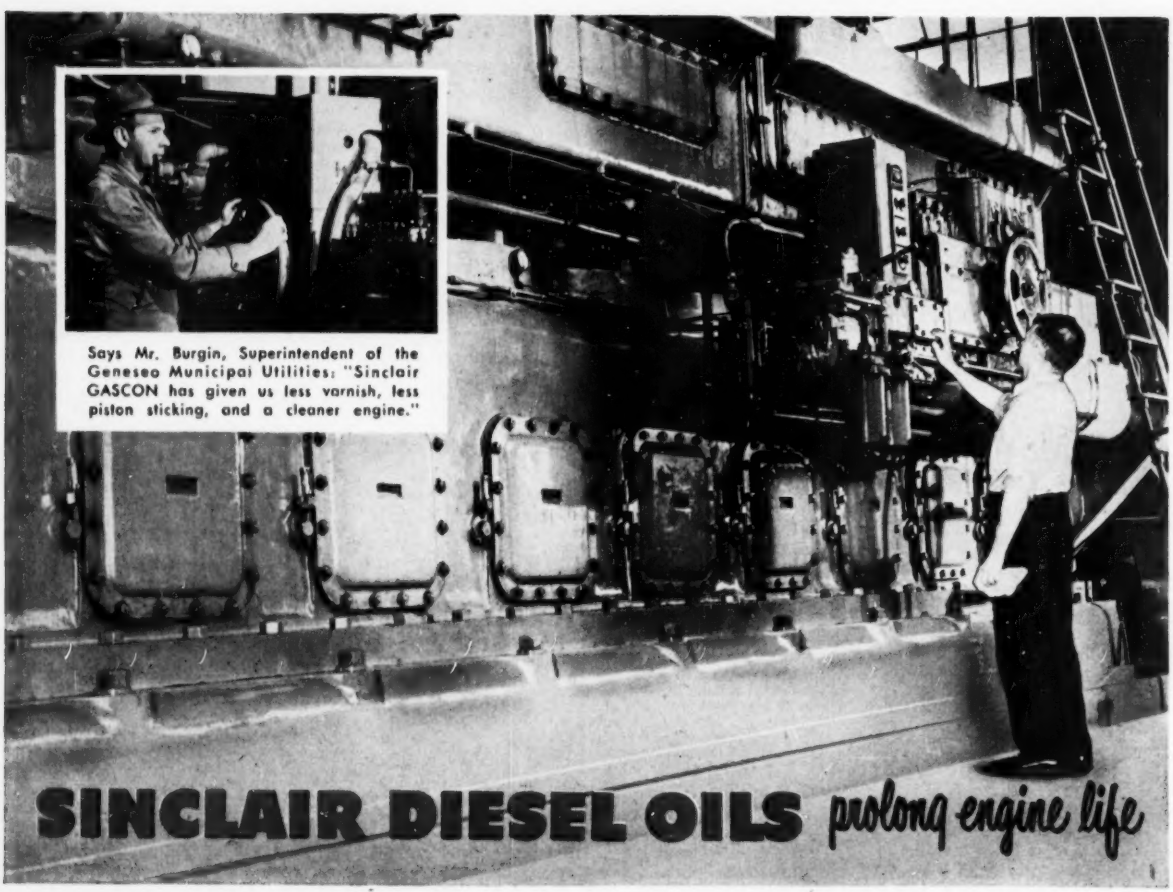
Light Plant Solves Problems of Sticky-Rings and Carbon-Build Up

For quite some time the Light Plant of Geneseo Municipal Utilities, Geneseo, Ill., had trouble with sticking rings, and with carbon deposits in the exhaust ports of its diesels. A few years ago these diesels were changed over to Sinclair Gascon *D*. Almost at once, it was noted that the troublesome conditions started to clear up. In the time since, sticking rings have become the rare exception and the carbon deposits are no longer a problem.

Furthermore, in 1947, a 1400 hp. Fairbanks-Morse engine, shown below, was installed and filled with Gascon *D*. This engine has never had a sticking ring and is running remarkably clean, with exceptionally low cylinder wear.

Perhaps Gascon® Oil can cure your diesel troubles, too. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.



Says Mr. Burgin, Superintendent of the Geneseo Municipal Utilities: "Sinclair GASCON has given us less varnish, less piston sticking, and a cleaner engine."

SINCLAIR DIESEL OILS *prolong engine life*

Editorially Speaking . . . .

What IS the Federal Power Policy?

PRESIDENT TRUMAN SENT A MESSAGE on March 13 to the annual convention of the National Rural Electric Cooperative Association, held in Chicago.

Our first reaction upon reading the published text was that of confusion. We had to check the date-line and the running head on the newspaper to be sure that it was not straight from Pravda. Such phrases as "vicious propaganda campaigns" and "forces of reaction" were bandied about with reference to the lobby of the private power industry, the President's particular target.

Having reassured ourselves that we were still in the U.S.A., we tried to make some sense out of the text. Again confusion. All that we were sure of was that the President was mad. The highest motives were ascribed to the government's entry into the power industry while the private power companies—the forces of reaction—were exacting a "toll" from consumers.

Apparently, "forces of reaction" are any segments of our economy that do not go along 100 per cent with the objectives of any bureaucratic scheme. We hold no brief for the private utilities—we have other fish to fry—but whether it is called an electric bill or a "toll", we like to pay it only once.

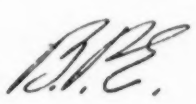
Unfortunately, a good sound and self-liquidating program—the REA—was indiscriminately lumped with special Authorities whose overall operation is, to say the least, open to question. Take many of the government's so-called cheap hydro electric installations, for example.

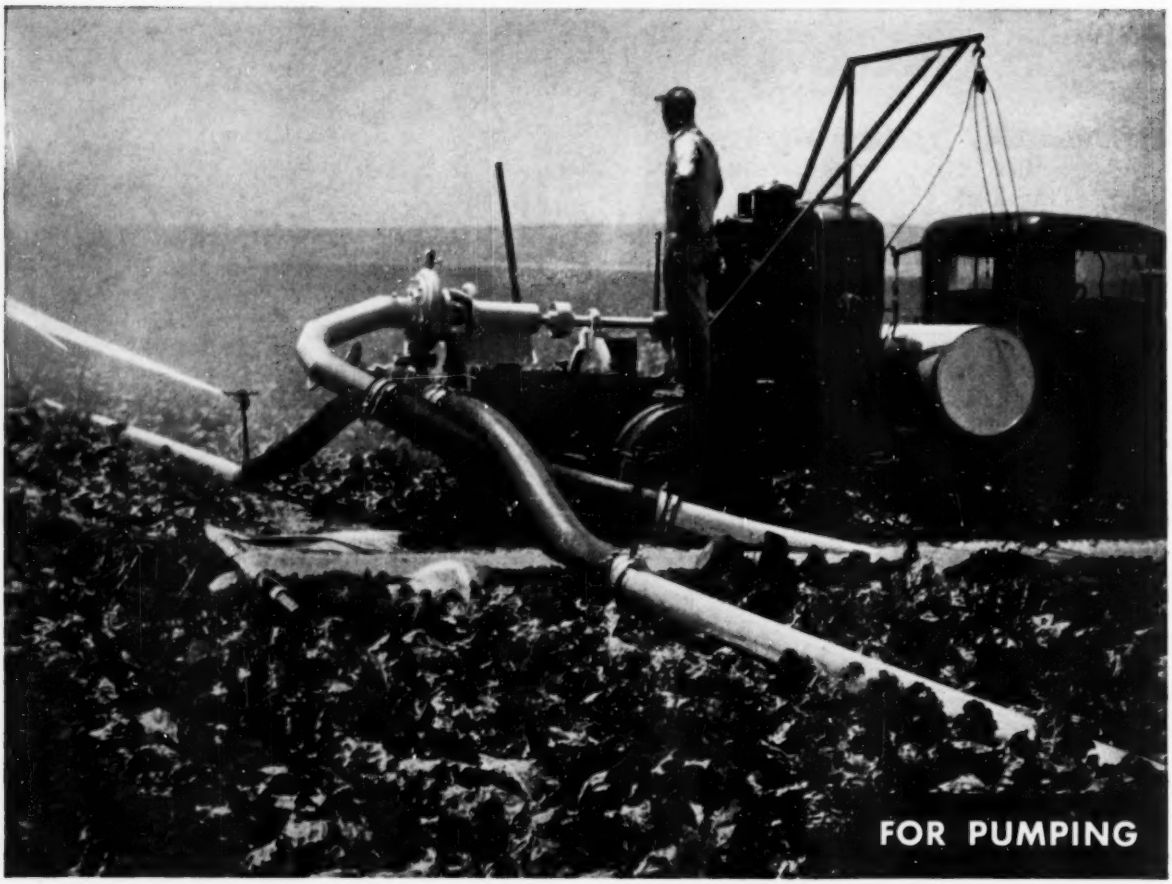
Undoubtedly, there are many who benefit through the availability of low cost power. But what about the rest of us? What is the relationship of rates to actual production costs? It is easy to lose sight of this important factor when fancy bookkeeping apportions costs among various associated governmental functions. Any actual deficits can be met with taxes and charged off to "Land Conservation" or some such program.

Will the electric bills pay for the huge generation plants planned to supplement the inadequate supply of power at some of these hydro projects? We doubt it; so the bill is paid twice—the second time in taxes. President Truman says that the Federal Policy is to spread the benefits of low cost electricity over the broadest consumer base. Is distribution of electricity over high-voltage lines to remote areas with "available demand" from a huge central source the cheapest procedure? How does it compare with the REA's sound policy of plants designed to meet the requirements of the area to be served. The answer lies in the fact that high-voltage lines are one of the most expensive methods of transporting energy.

As a sidelight, does the Federal Power Policy embrace such deals—sanctioned by the government—as the one in Arkansas where one of the members of the "forces of reaction" got the nod over a private industrial power plant. And also the one in Texas where a plant is to be built by a huge private utility with a few so-called "new features" added to get a rapid tax amortization at the expense of all of us, instead of a proven-design private industrial plant. Who pays in the end?

No, the President will have to do better. You can't take a vacillating and economically unsound part of a program, lump it together with a sound and successful program—the REA—and sell the whole package. The cooperatives work because they are economically sound to begin with; they are spending their own money, and can see the results. On the other hand, we never saw a large political governmental project that wasn't expensive and wasteful.





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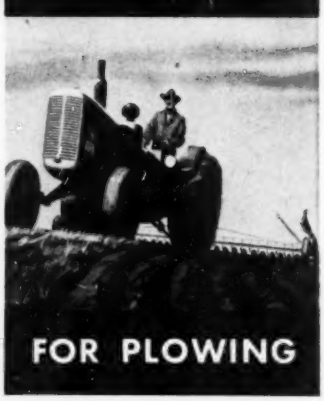
for any job from 32 H.P. up

MAYBE this headline surprises you, but it's a fact. General Motors has made it possible to have Diesel power in places where it was never used before—even on jobs requiring as little as 32 horsepower.

The reason is that GM engineers have compressed Diesel power into a smaller, lighter weight engine that provides Diesel economy and Diesel efficiency without sacrificing ruggedness. This sturdy 2-cycle Diesel fits almost anywhere a gasoline engine does—*and gets more work done faster, easier and cheaper.*

It is simple to operate. It starts quickly. It burns fewer gallons of safer, lower-cost fuel. It takes less time out for servicing. And it costs less to maintain than either gasoline or other Diesel engines.

You can have this thrifty, hard-working Diesel in more than 750 different kinds of equipment built by over 150 manufacturers. Write us for the list. And ask your GM Diesel distributor to show you the savings this Diesel can make in *your* kind of operation.



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Single Engines...32 to 675 H.P. Multiple Units...Up to 800 H.P.

+ HIGHLIGHTS +

● Class I railroads in the U. S. installed 487 new locomotives into service during the first two months of this year. All except three were diesels.

● The hazards of running a railroad was recently brought out when the OPS brought suit against the Pennsylvania RR for increasing the charges of its rest room facilities. Subject to treble damages this comes to $385,244.82. Oh well, if we can just hang on until November. . . .

● In 1951 Class I railroads moved an average of 21,767 net ton-miles per freight train at an average speed of 17 mph. This is by far the highest average on record. As dieselization becomes more complete it is reasonable to expect these averages to be still further increased.

● Pacific Northwest Pipeline Corp. is proposing to build about 828 miles of pipeline, mainly in Washington, at an estimated cost of $58,425,000, including working capital. The proposed transmission system would include 635 miles of transmission line, 175 miles of spur lines, and three compressor stations with a total of 14,080 hp.

● Southern Natural Gas Co. has filed an application with the Federal Power Commission proposing a $76,317,300 construction program which would increase the delivery capacity of its gas transmission system to 1,020,000,000 cu. ft. per day. Project would involve construction of about 1254 miles of pipeline and 22,250 compressor hp.

● Plans for construction of a 330-mile oil products pipeline from Salt Lake City to Boise, Idaho were announced recently by the Salt Lake Pipeline Co., a subsidiary of the Standard Oil Company of California. Cost will be $8,000,000 with work beginning in a few months if steel is available.

● Automotive Engine Rebuilders Association has quite adeptly expressed the spirit of the scrap drive and parts shortage situation with the slogan—"IF YOU CAN'T REBUILD IT—SCRAP IT.

● A cut of about 103,000 bbl. of oil a day was ordered by the State Railroad Commission in Texas for the month of April. Signs that the state was producing too much oil for the market was given as the reason.

● A new angle on metal scrap recovery was brought out by a Hartford, Conn. gun club. Shooting clay birds for 25 years, they recently "mined" out the range for lead pellets. Result—they sold the "lode" for $35,000.

● A Government petroleum expert recently took California oil men to task for failing to drill more wildcat or exploratory wells. The oil men were told that in case of another all out war it was necessary that new reserves be discovered.

● To save vital copper and stainless steel, the Navy is substituting plastic piping in their new minesweepers. Besides costing a fraction of copper nickel and stainless steel pipe, the Bureau of Ships announced that in an 8 month test, plastic pipe held up where metallic pipe failed due to corrosion, shock and vibration.

● Quote from a recent letter from a reader in Israel. "Though young politically, Israel is taking leaps and bounds as far as industry is concerned. . . . More and more, people are turning to the workhorse of the industry—the diesel. In a country where the diesel was known practically only in the agricultural field, it is now replacing gasoline engines in transport, and steam engines in power plants, besides being used extensively in road construction and generally helping to build up this country."

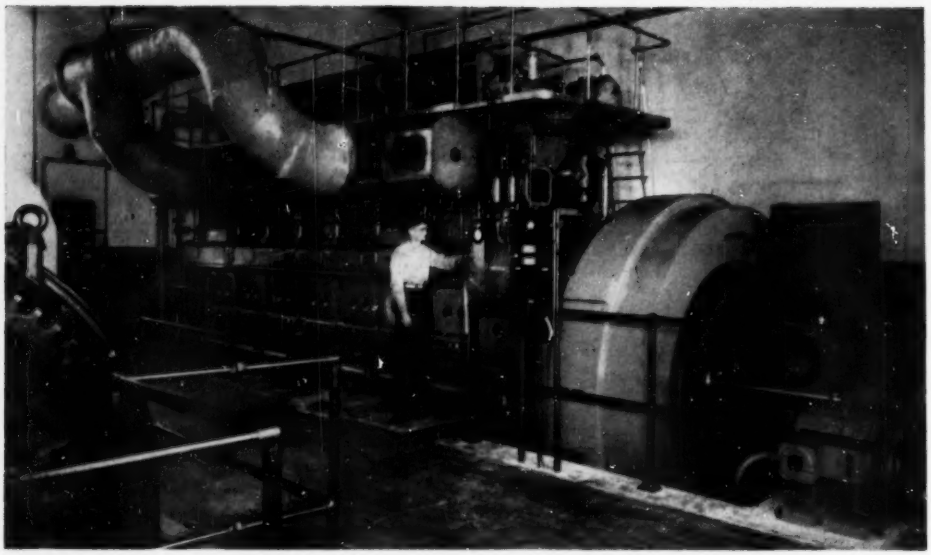
● First of ten diesel locomotives to be used in freight service between Halifax and Montreal on the Canadian National Railways was delivered recently. Builder was the Montreal Locomotive Works.

● The Army's workhorse, the 2½-ton cargo truck is now being equipped with hydramatic drive. It has four main speeds with a high and a low range in each, or a total number of eight forward speeds. Training drivers is expected to take less time with the hydramatic as well as reducing driver fatigue. This idea might be carried to over-the-road commercial trucks.

● Total dollar sales of all GM products were only 1 per cent lower in 1951 than in 1950, but net income was off 39 per cent it was disclosed recently in the company's annual report. Reasons given were higher taxes, restrictions on civilian production, higher costs without compensating price increases, and an increasing volume of defense production at a lower profit margin than that earned on civilian products.

● British Railways have now completed their first experimental gas turbine locomotive. Their work parallels that going on in several countries including our own. Metropolitan-Vickers Electric Co. of Manchester, built the first unit of 2540 hp. with sufficient tractive effort to start the heaviest passenger train on the steepest grade in Britain. Diesel oil is used for fuel.

● Thermal indicators made of paper developed by the Army Quartermaster Corps, are capable of instant temperature readings from 115 to 500° F. The thermometer consists of white pigment coating on black paper, which melts into paper base leaving black background. These indicators can be used by color-blind persons—a drawback of indicators used by industry which depend on color changes.



Newest and largest (2800 hp.) of six Fairbanks-Morse engines that through use of gas has slashed generating costs.

Dual-Fuel Engine Proves Money Maker for Falls City, Neb.

F-M 2800-hp. unit generates power at a fuel cost of 3.15 mills per kw. hr. giving this city some of the lowest electric rates in Nebraska.

A NEW 2800-hp. Fairbanks-Morse dual-fuel engine is producing power in the Falls City, Nebraska, municipal plant at a total fuel cost of just 3.15 mills per kw. hr. This economy is being achieved with 20-cent gas and 11-cent fuel oil and represents a saving of 63 per cent compared with previous diesel fuel costs.

The big engine is a Model 31AD18, with eight cylinders of 18-in. bore and 27-in. stroke, developing rated horsepower at 277 rpm. and drives a 1984-kw. Fairbanks-Morse alternator with 25-kw. V-belted exciter.

The Falls City plant illustrates both modern engine economy and diesel durability. The first engine installed when the city switched over from steam power in 1926 was a 720-hp. Model 33 style M Fairbanks-Morse diesel. This same unit is still in operation every day, teaming up with the new engine to carry the load.

The story of this plant's expansion serves as an example of the satisfaction obtained from diesel power. In 1928, an 840-hp. style M went into service. Two years later, a 1000-hp. unit of the same type was installed. In 1936, a 1400-hp. model 33D was put in, and in 1942, a 1600-hp. model 33E was added. All of these were 2-cycle, pump-scavenging, mechanical-injection Fairbanks-Morse diesels.

Finally, in December, 1950, the 2800-hp. engine went into full service as a diesel and generated more than 1,000,000 kw. hr. in the following three months at an average of 14.07 kw. hr. per gal. of fuel. Then, in March, 1951, the unit was switched to natural gas and began to slash fuel costs in earnest.

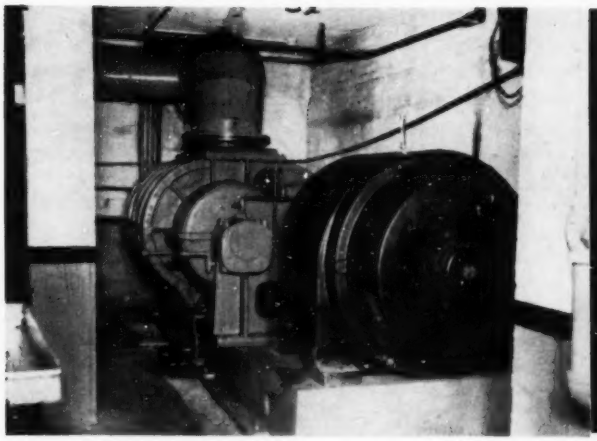
The first real indication of what could be accomplished was the first half of the city's fiscal year 1951-52, the period from May through October, 1951. In these six months, the new engine produced 2,442,000 kw. hr., 46.3 per cent of the plant total of 5,263,700 kw. hr.

This becomes significant when translated into dollars and cents because the dual fuel engine produced a kw. hr. at the following cost:

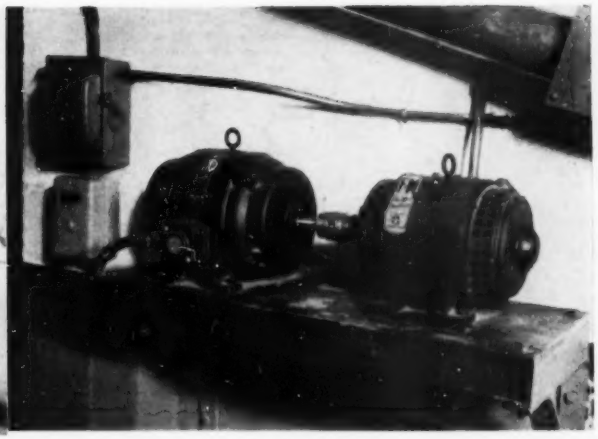
Cost pilot oil	$0.00077
Cost gas	0.00238
Total fuel cost	0.00315

In the fiscal year 1950-51, the diesels averaged a fuel cost per kw. hr. of $0.00845. Thus, the new engine cut fuel costs 5.3 mills per kw. hr., a reduction of 63 per cent. In the six-month period reported, this meant a saving of nearly $13,000.

A 30-32 gravity gas oil is used for pilot fuel. Stored in two 12,000-gal. tanks, it is transferred by a motor-driven pump through duplex bag-type filters to an elevated day tank from which it flows through a meter and another duplex filter to the separate pilot oil injection pumps on the engine. The natural gas reaches the plant at 35 lb., then passes through an orifice-type meter and a regulator which cuts it down to 30 lb., the pres-



Scavenging air blower for new engine is driven by 200-hp. induction motor. Power comes from generator of engine served.



Small F-M motor-generator set forces engine's generator field to give quick surge of power to blower motor when starting.

sure at which it goes to the engine.

The engine can be switched instantly from dual-fuel to full diesel operation and there is a second day tank for the 26 gravity diesel fuel. Fall City is in the midst of the oil fields and the viscous, paraffin-base fuel is delivered hot from a nearby supplier and stored in two steam-heated tanks with combined capacity of 43,000 gal. This is the oil used for all the diesels.

The SAE 40 lubricating oil is circulated under pressure to the bearings and up into the pistons by a built-in, engine-driven pump. Included in the circuit is a shell-and-tube oil cooler. Some lube is bypassed from the pressure side of the pump to a fuller's earth, cartridge-type filter from which it is returned to the crankcase.

The big engine has a separate cooling system with a pair of 6-in. centrifugal pumps driven by 20-hp. motors to circulate soft water through the engine jackets and the coils of an atmospheric tower. The tower is set in a pond in such a way that water level can be raised to cover the coils during the winter. An 8-in. turbine pump puts water through the tower sprays. Either rain water or 12-grain city water is used for makeup. The latter is brought to 4 grain hardness in a zeolite softener.

Scavenging air is drawn through a vertical intake silencer into an air house holding 24 filter elements. Air is supplied to the engine by a blower driven by a 200-hp. induction motor which derives its power at 2400 volts directly from the generator of the engine served. A little 1-kw. dc. generator driven by a 2-hp. motor is used to force the generator field in starting to insure a quick surge of power for the blower motor.

Fully equipped with automatic safety devices, the engine cannot be started unless lube pressure is brought up with the motor-driven auxiliary lube pump. The gas is shut off if scavenging air pressure, lube pressure, cooling water pressure or pilot oil pressure drops below prescribed minimums. If the gas supply fails, the engine switches automatically to oil.

This city of 6200 population has some of the lowest electric rates in the state of Nebraska. Here is what consumers paid for electricity in the six months ending October 31, 1951:

Residence Light Sales

4¢	573,652 kw. hr.
3¢	421,382 kw. hr.
2¢	717,281 kw. hr.

Commercial Light Sales

4¢	492,968 kw. hr.
3½¢	623,356 kw. hr.
2¢	96,104 kw. hr.
1½¢	110,100 kw. hr.

Commercial Power Sales

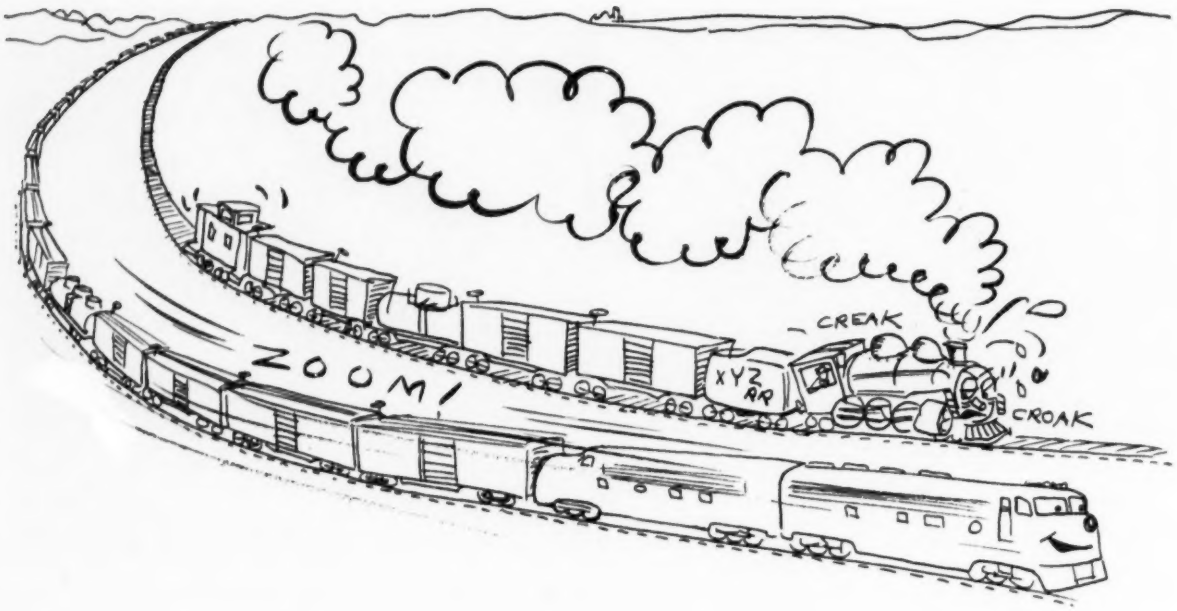
3½¢	286,854 kw. hr.
2½¢	62,000 kw. hr.
2¢	186,360 kw. hr.
1½¢	1,252,600 kw. hr.

In spite of the low rates, the plant shows a substantial profit. In the six-month period under consideration, revenues totaled $132,930.74, while the department expenses, including generation, distribution and administration came to $81,552.29, leaving a profit of $51,378.45 for the half year.

The plant is operated under the direct supervision of G. G. Wendt, superintendent of the water and light department, a man of long diesel experience. Policy matters are handled in consultation with Mayor Paul Zimmer and the six-man city council.

List of Principal Equipment

All Engines	Fairbanks-Morse & Co.
Generators	Fairbanks-Morse & Co.
Governors	Woodward Governor Co.
Fuel transfer pump	Roper Corp.
Fuel filters	Wm. W. Nugent & Co.
Fuel meter	Buffalo Meter Co.
Gas meter	The Bristol Co.
Lubricating oil	Socony-Vacuum Co.
Cylinder lubricators	Madison-Kipp Corp.
Lube cooler	Ross Heater & Mfg. Co.
Lube filter	The Hilliard Corp.
Auxiliary lube pump	Viking Pump Co.
Cooling water pumps	Fairbanks-Morse & Co.
Intake silencer	Maxim Silencer Co.
Air filters	American Air Filter Co.
Scavenging air blower	Roots Connersville Blower Corp.
Blower motor	Fairbanks-Morse & Co.
Motor-generator set	Fairbanks-Morse & Co.
Exhaust silencer	Maxim Silencer Co.
Gauge board	Fairbanks-Morse & Co.
Exhaust pyrometer	Illinois Testing Laboratories, Inc.
Switchboard	General Electric Co.



Facts on Today's Railroads

Facts and figures on the current status of dieselization of Class I railroads, their operational role, and economies were recently presented at a DEMA Meeting by Volney B. Fowler, Assistant to the Vice President, Electro-Motive Division of General Motors. We think that you will agree that they are startling.

Status of Dieselization

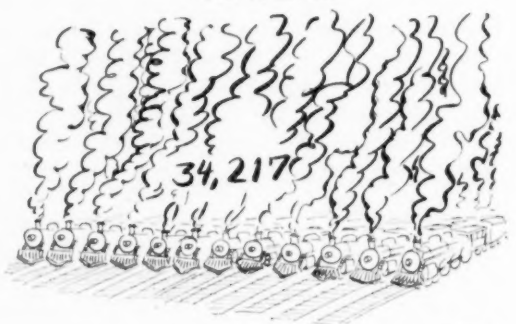
Eighteen of the more than 150 Class I domestic railroads (roads grossing over $1,000,000 a year) were completely dieselized on December 31, 1951. They were:

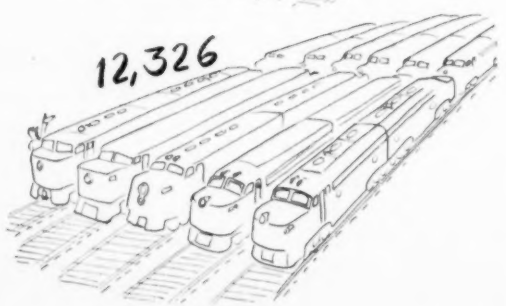
Atlanta & St. Andrews Bay	Lehigh & New England
Atlantic & Danville	Minneapolis & St. Louis
Chicago & Eastern Illinois	New York, Ontario & Western
Chicago Great Western	New York, Susquehanna & Western
Chicago, Indianapolis & Louisville	Sacramento Northern
Detroit & Mackinac	Spokane International
Elgin, Joliet & Eastern	Staten Island Rapid Transit
Gulf, Mobile & Ohio	Texas Mexican
Lehigh & Hudson River	Toledo, Peoria & Western

Practically all of the other railroads are partially dieselized and have substantial numbers of additional diesel-electric locomotives on order. There were a total of 34,217 locomotives of all types at work on U. S. Class I railroads as of January 1, 1952. Of these, diesels constituted only 12,326 locomotives.

One note of caution: Be careful in studying figures on diesel population on the railroads. Always make sure whether they refer to locomotives or units. The 12,326 locomotives mentioned above were made up of 17,619 units.

"Sure! There are more of you but look next door and see what we can do!"





Units cannot be accurately compared with steam locomotives. The ratings of a great many steam locomotives are the equivalent of two or more diesel units. The reason for this is that diesels are built in smaller packages of power which can be conveniently coupled to make up the locomotive required to fit the particular job. In steam, you are stuck with the original horsepower, whether you need it or not.

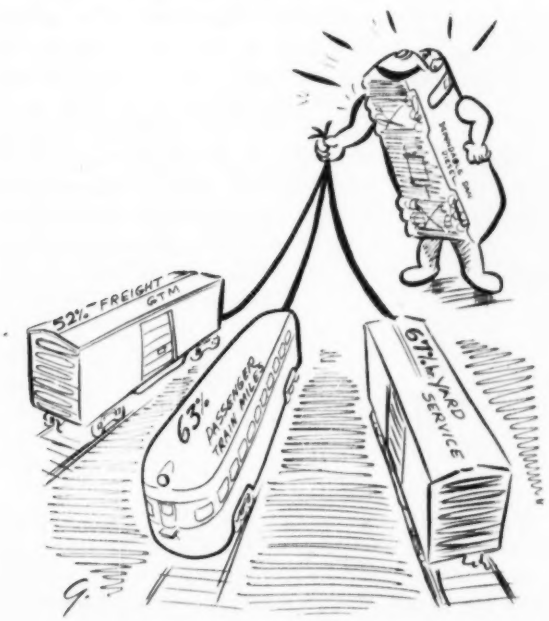
Straight numerical comparisons between diesel and steam locomotives are meaningless. For a factual comparison, it is necessary to analyze the ability of each to perform the job.

Operational Comparison

Constituting only 36 per cent of the total number of locomotives in service, it is significant that in the eleven months ending November 30, 1951, 52 per cent of the gross ton-miles of freight were hauled by the diesels. In the same period, 63 per cent of the passenger train-miles and 67 per cent of the locomotive hours of yard service were performed by diesels.

An even more startling comparison relative to freight service proves that the diesel is the "work horse" of the railroads and not the "prima donna", getting all the choice runs as has so often been contended. In this service, 23 per cent of the locomotives were diesels and yet they were doing 52 per cent of the total work.

There is no question but that fewer diesel locomotives will be required to the total job than would be the case if steam locomotives were used. The flexibility attained by the use of units, greater starting tractive effort permitting longer trains, and higher percentage of availability are some of the reasons for this. This contributes to economy of operation, but there are more direct factors.



"You fellows eat too much. Digging your grave with your teeth, you know——"

Cost Comparisons

Why have the railroads so completely swung into the "gold rush" to dieselize? There is only one answer: To make money. Take fuel costs. Every attempt is made to use the expensive railroad equipment to the fullest degree and thus fuel costs are a big factor in operating expenses.

Switcher Service—As an example of costs in this type of service, costs for fuel burned in various types of switchers are given for the first four months of 1951 in terms of "per yard switching hour":

In coal-fired switchers	$2.45
In oil-fired steam switchers	3.09
Current in electric switchers	1.12
Fuel in diesel switchers	.68

In other words, it cost 63 per cent more to feed electric switchers; 255 per cent to feed coal-fired steam switchers; and 349 per cent more to fuel oil-fired steam switchers, than diesel switchers.

Freight Service—For the same period, fuel costs per 1000 gross ton-miles of road freight service were:

Fuel in coal-steam locomotives	33 *cents*
Fuel in oil-steam locomotives	40 *cents*
Current in electric locomotives	29 *cents*
Fuel in diesel locomotives	16 *cents*

Expressed differently, in terms of fuel to haul freight for other types of locomotives in comparison with diesels, it cost:

141 *per cent more by oil-burning steam*
101 *per cent more by coal-burning steam*
75 *per cent more by electric locomotives*

Passenger Service—A passenger train car mile in the same period cost for current or fuel:

In coal-fired steam locomotives	5.7 *cents*
In oil-steam locomotives	5.0 *cents*
In electric locomotives	3.7 *cents*
In diesel locomotives	3.0 *cents*

These same figures expressed in percentages greater than the cost for diesels are:

90 per cent more in coal-steam
66 per cent more in oil-steam
23 per cent more in electric

Another set of reports disclosed that in the first four months of 1951:

1. Diesels handled 64.6 per cent of the total yard switching hours of Class I railroads at only 33.4 per cent of the total fuel cost of these railroads for this service.

2. Diesels handled 48.1 per cent of gross ton-miles in freight service at only 30.8 per cent of the total fuel bill.

3. Diesels handled 59.8 per cent of the passenger train car-miles at only 46.3 per cent of the total fuel cost.

Summing It Up

Two of the most important advantages of diesel locomotives have been discussed. There are many others. Not only do the railroads benefit, but the nation as well. For example, in 1941 the average gross ton-miles of operating per freight train per hour was 34,684. In 1951 (first 11 months) it was 46,499.

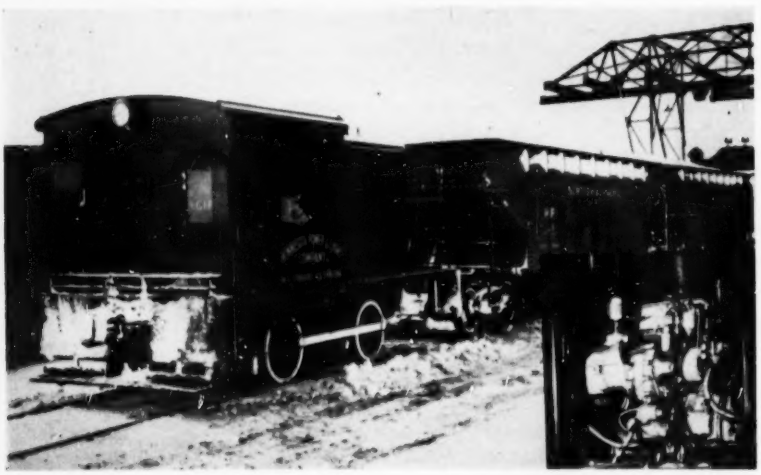
Dottie Diesel——
". . . and I'm available 95 per cent of the time!"

In other words, there has been a 34 per cent increase in the ability of the railroads to move goods over a ten year period.

The figures and facts are clear. There is now sufficient experience in the records to support the rule of thumb which is generally accepted on the railroads. Lumping all classes of service together:

> "Diesels do one-third more work at about one-half the cost of steam locomotives."

Diesel Yarder Replaces Steam Crane



Shown above is a 25-ton Davenport-Bessler yard locomotive that has replaced a steam locomotive crane. This change all took place in the yards of the Minnesota Power and Light Company of Duluth, Minnesota. The switch in equipment accompanied a change in the method of operation.

Greater flexibility of operation and improved economy is claimed as a result of the switch. The equipment is used chiefly for spotting coal cars for unloading as needed by the power plant. Operation is not constant and there are numerous idle periods.

According to V. A. Miller, the company's chief engineer, the instant availability of diesel power without necessity of servicing during idle periods simplified yard operation as well as saving on fuel costs. Under present load conditions these costs average approximately $0.30 per day.

Another advantage from the operational point of view is the greater margin of safety for the yard switchmen. This is due to the greater ease of handling and excellent visibility from the cab.

Locomotive power is provided by a GM Series 71, 6-cyl. engine shown in the inset. Power is supplied to the wheels through a torque converter.

Washington Slant

THIRD QUARTER ALLOTMENTS are reportedly going to be higher for the Second Quarter. Optimism is also expressed as to additional materials obtainable via the "appeals" route. Extreme pinch expected when production got rolling is not materializing: In fact, the opposite seems to be true. One reason is increased materials from primary sources and materials "deals". Another is the stretch-out or lag (take your choice) in armament program. Huge defense funds remain unobligated.

RUMORS THAT CMP IS TO BE REPLACED are persistently heard. Whole new set-up is expected, but as yet no details are available.

BASIC MATERIALS AND ALTERNATES are listed in Issue No. 5 put out by DPA's Conservation Division. Shows relative availability of basic materials and indicates some available alternates. Published bi-monthly as a guide. Reports: Steel—tendency to ease spottily, although scrap remains at low levels; refined copper—still critically short, although flow of secondary has improved slightly; tin, zinc and chemicals—slightly improved; other materials—no important change.

RAILROAD IAC charged that Second Quarter allotments did not reflect the industry's essentiality and was only sufficient for replacement of obsolescent equipment. Declared that stockpiling should be allowed in anticipation of future national emergencies. Original allotments permitted 700 locomotives to be built: 582 for domestic railroads; 50 industrial type; 44 for export; and 24 for military use. Supplementary allotments were given for 100 additional locomotives with 50 more authorized, if materials could be squeezed out of inventories or by conservation. Operators recommended closer consultation with IAC by DPA and DTA prior to the firming of production schedules and also that DTA appoint fully-conversant official to DPA's Requirements Committee.

WATER AND SEWAGE PROBLEMS were discussed in a meeting under sponsorship of the Water Resources Division, NPA. Topic was proposed Order to centralize various regulations affecting water and sewage systems and liberalize some existing promisions.

WATER AND SEWAGE CONSTRUCTION APPROVALS were announced for 935 construction projects with a value totaling more than one-half billion dollars. Figure includes materials, labor, engineering, and land in some cases. With most projects municipally owned, financing (the first step) has been difficult in view of uncertain materials situation. Detailed list of approved projects (can be seen in Dept. of Commerce field offices or NPA Office of Public Information, Wash.) should include some activated sewage sludge plants, a natural for engine sales.

MINING MACHINERY TAKING A BEATING according to members of this IAC. While production schedules for new equipment and repair parts are generally being met, some materials are being borrowed from "new machine" kitty to build spare parts. Continuation will jeopardize production. Round-the-clock use and heavy punishment is blamed for high parts requirements.

SHORTAGE OF TRUCKS is reported due to curtailment of production schedules. Manufacturers recommended in IAC meeting that 55,000 additional trucks be authorized for Second Quarter (originally 220,000 units). Bulk of light and medium-weight truck manufacturers reported ability to produce authorized quotas, while the heavy truck boys (many using diesels) were feeling the worst pinch. Pressure for increased allotments on basis of materials availability and to stave off unemployment resulted in additional materials allotments for 30,000 more trucks.

ENGINE MANUFACTURERS (750 rpm. and up) have been instructed to file separate applications for future allotments for replacement engines, spare parts and new engines. Reduced aluminum allotments(expected to be increased at least by Third Quarter) were reported as limiting factor in production. Major problem also reported was inability of radiator suppliers to get copper. As subcontractors, engine manufacturers complained of not getting high priority ratings for Dept. of Defense and AEC orders, hampering procurements of "B" components necessary for manufacture.

TRACTOR, ALLIED EQUIPMENT MEETING aired inadequate allotments and serious unbalance of materials allotted. Unless straightened out, layoffs of from 30 to 40 per cent are anticipated and defense needs for tractors will not be met. NPA said it would request Third Quarter allotments on basis of annual crawler tractor production of 58,000 or about 14,510 per Quarter. Production in 1951 was 43,561 tractors but on basis of Second Quarter allotments only 34,000 would be produced in 1952. Demand is much greater—about 64,571—based on claimant agencies' requests.

Two International TD-24 tractors being used to push-load self-propelled scrapers.

Diesels Speed Work on New Marine Base

BIGGEST of Marine Corps supply depots now under construction, and one of the largest units of its type anywhere is huge DOSAGA—Marine Corps Depot of Supplies, Albany, Georgia—requiring a million and a quarter yards of earthmoving to prepare the one-mile-wide by seven-mile-long site. Original contracts total slightly over two and a half million dollars and provide for the initial operations of clearing, grading, constructing drainage facilities, railroads, as well as access roads and streets.

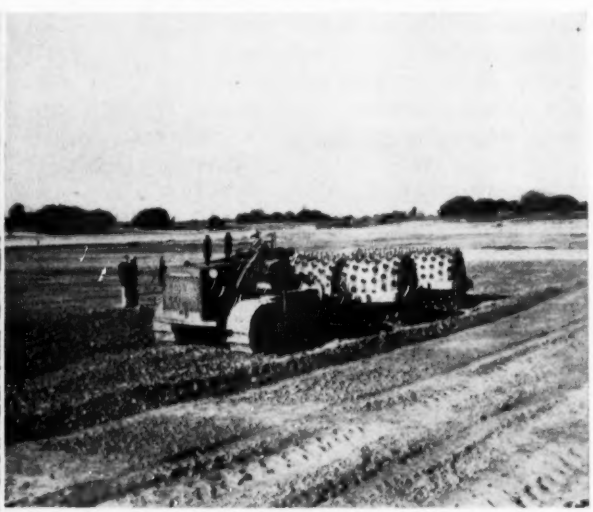
Begun October 15, 1951, the present earthmoving contracts require completion within 200 calendar days. Additional contracts will be let early in 1952 for ten large warehouses costing approximately $1.2 million each.

Included in the initial contracts are approximately eight miles of railroad and a very large drainage ditch which will empty into the nearby Flint River. From the edge of the depot site, the ditch will extend nearly four miles to the river and will have a bottom width of 22 feet with a 2½ to 1 back slope. Eventually, the ditch will be extended back into the depot site for about five miles more, making a total length of nine miles. Two railroad trestles and five road bridges will be built spanning this ditch. To prevent erosion, the entire ditch will be sodded.

The original contract for site grading, drainage, and railroad excavating, amounting to $1,641,000 was let to the J. A. Jones Construction Com-

Marine Corps equipment—International TD-24 and 18A with scraper—being used to build patrol road around DOSAGA.

Compaction—95 per cent—of fill in one of two limestone "sinks" with International TD-18A pulling sheepsfoot roller.



Self-propelled scraper pushed by dozer takes bite from drainage ditch at intersection of drain.

pany of Charlotte, North Carolina. Wright Construction Company of Columbus, Georgia, is the subcontractor for the earthmoving work. The $450,000 railroad construction contract was let to the Bailes-Sey Company, Jacksonville, Florida, and the Pafford Construction Company of Waycross, Georgia, was the successful bidder on the $432,000 contract for 2¾ miles of drainage ditch and sewage disposal lines, three highway bridges, and two railroad trestles.

Selection of Albany by the Marine Corps was based on the city's position as a rail and highway hub with connections to Savannah and Jacksonville on the Atlantic and Pensacola and Mobile on the Gulf of Mexico. Even severe enemy attack would leave lines of transport and communication open to one or more deepwater ports.

At present, the bulk of Marine supply facilities are concentrated on the Pacific Coast, a natural result of the last war's huge trans-Pacific requirements. Eastern installations are comparatively small and crowded and would be seriously strained supplying a fighting front in the Atlantic region. DOSAGA will solve this problem and, while it will take four years at the present rate to finish the gigantic depot, the various facilities will be put into operation as they are completed.

The earthmoving contractors have been instructed to preserve all the trees on the site except where they are directly in the path of roads, railroad spurs, or drainage installations. A large grove of pecan trees at one end of the area has been carefully preserved. Just before the construction work began, the pecans were harvested and shipped to Marine installations all over the world. The topsoil is also being stockpiled for final landscaping when earthmoving and construction is completed.

The site originally had poor drainage with surface water settling in two large limestone "sinks". The Wright Company is filling these spots with a total of 450,000 cubic yards of earth fill. Since two of the shops will occupy these spots, 95 per cent compaction is required for the final grade.

Shaping portion of the big ditch (looks more like a road) eventually to be nearly nine miles long, emptying into Flint River.

Preparing grade for part of DOSAGA's 22 miles of railroad track. International TD-24 and Bucyrus-Erie scraper spread fill.

Fig. 1 WELDING STAGES in repair of aluminum pistons. Starting left—ready for weld; top ring groove filled; top and second groove filled; completely welded ready for machining; finished including pin fit. Small welded piston shows build-up of pin boss to restore fit.

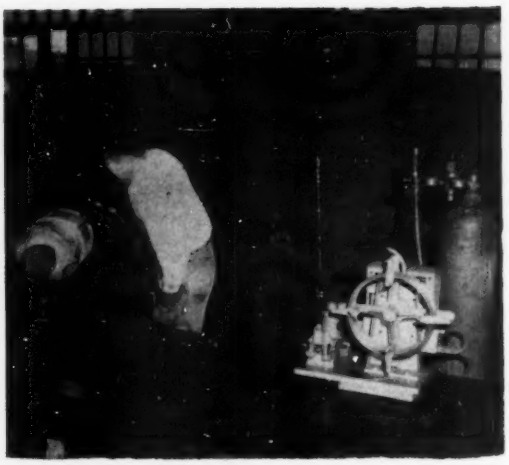


Fig. 2 PROCESS OF BUILDING UP worn piston ring grooves is shown. Piston is held in jig and rotated slowly by motor seen. At right is complete automatic unit with a cylinder of gas.

Reducing Locomotive Maintenance and Repair Costs by —

Reclaiming Parts with "Heliarc" Welding

Welding is assuming even greater importance in the railroad field with the introduction of inert gas shielded arc welding. Here is a description of the process and how it is now possible to make better and faster welds with ferrous as well as the more common non-ferrous metals.

*by C. R. Strutz**

WELDING by various methods has always played an important role in production and repair of railroad equipment. Many processes and procedures were adequate for work on the older types of equipment, but after the introduction of the diesel engine on railroads, several of the older methods were placed in a secondary position by the type and quality of the welding required.

In these critical times of increased costs, material control and shortages, welding becomes even more important. Repair and reclamation of parts by welding helps to keep costs down and to improve material shortage situations. Also, lower level inventories, lessened obsolescence charges, as well as high availability of equipment are possible.

Fortunately the inert gas shielded arc welding process employing "Heliarc" apparatus, has been developed in recent years to such an extent that many parts formerly most difficult to reclaim by former methods can now be reclaimed satisfactorily.

"Heliarc" welding is characterized by speed, high quality of the weld metal deposited, economy of production, together with the advantages of elimination of flux and the smoothness of deposit. In addition, it is possible to readily weld stainless steels and non-ferrous metals.

Equipment

Various features of the Heliarc torch normally used are as shown in Fig. 3. The arc is formed between tungsten electrode and the work. Electrode, arc and fused metal are surrounded by a monatomic inert gas (usually argon) and the weld zone is thereby protected from atmospheric contamination. Welding current is conducted to the tungsten electrode by a water-cooled electrode holder.

At the end of the torch a cup helps to confine and maintain a concentration of the shielding gas in the welding zone. Two hoses and a water-cooled power cable supply the shielding gas, cooling water, and electric current. The water-cooled handle, holder and power cable make it possible to design a light maneuverable torch with unusually flexible leads despite the high currents used.

Applications

PISTON REPAIR—The reclamation of aluminum pistons is one of the primary uses of this type of welding on diesel locomotive parts. Normal repairs consist of welding cracks in the

**Abstract from a paper presented before The Southeastern Railway Diesel Club at Jacksonville, Fla. Mr. Strutz is Manager of the Mechanical Dept., Oxweld Railroad Service Co., A Division of Union Carbide and Carbon Corp.*

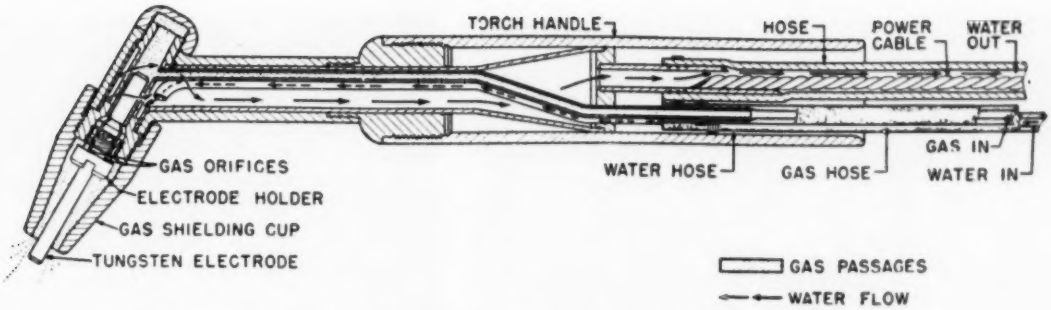


Fig. 3 HELIARC TORCH shown in section. Arc is formed between tungsten electrode and the work.

top of pistons and rebuilding worn ring grooves. Fig. 4 shows one piston as prepared for welding of cracks across the top and another "as-welded" which shows the appearance of the finished weld.

These cracks seem to form in the area subjected to the concentrated heat immediately under the injector. The crack is chipped out to sound metal. The piston is then preheated generally by oxy-acetylene flame and wrapped in asbestos which maintains the preheat during the welding operation.

The building up of worn ring grooves (later to be brought back to standard by machining) is done by placing the piston on its side in a turning jig. A protecting cover is used to maintain preheat while metal is deposited in the grooves. (Fig. 2).

These piston repair operations are quite economical. New pistons cost up to $200 each, while the average reclamation cost will amount to approximately $25, including the necessary machining.

RECLAIMING CAST IRON CYLINDER HEADS—Tests are made for water leaks by applying hydraulic pressure —any leaks found are marked. The heads should next be given the Magnaflux test to detect any fire cracks in the stud holes where head is bolted to the cylinder. All detected cracks are chipped or ground down to the water space. Grinding with a thin emery wheel is preferred. (Fig. 5).

The head is preheated in an oil furnace to a temperature of about 1500° F. and then placed in an insulated box or work case with openings through which the welding is done on only a small exposed area.

The box is fastened to a jig that permits the part to be revolved and also turned on its side, so that welding is usually done in a downhand position.

Fig. 4 PREPARATION FOR WELDING is shown on left piston while the appearance of finished weld is seen on crown and top ring groove of right piston.

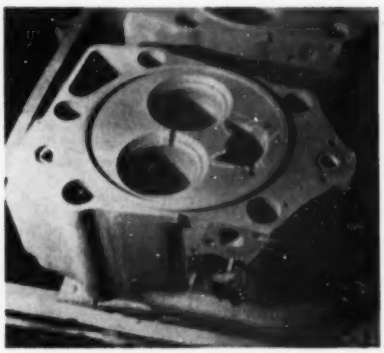


Fig. 5 GRINDING OF CRACKS in cast iron cylinder heads in preparation for welding. Leaks are hydraulically found and a thin emery wheel used.

Generally sufficient heat is retained to allow completion of the welding. Parts are then immediately post-heated and placed in insulated boxes which permit complete cooling in about 24 hours.

Valve seat building up is one of the foremost operations in the reclamation of cast iron cylinder heads. The area around the circumference of each seat is first melted down completely with the inert gas-shielded arc process without adding any metal. This step has been found to be important as the seat will be defective when finished, if not done. A cast iron rod is then used at the front of the molten puddle to supply additional metal. Care must be taken not to dip the rod into the puddle as this will cause harmful porosity as proven by experience (Fig. 6).

After the valve seats and injector hole are rebuilt, the operator welds any cracks in the side of stud holes. This is done with the head placed on its side. The box has a covered opening on the side so that the stud hole can be welded downhand.

Economy in reclamation of these cast iron heads is seen when the cost new, which can be as much as $250, is compared with the cost of reclaiming, which is approximately $19.

UP-DATING OF PARTS—Water passage ports in the cylinder heads and liners were changed from elongated shapes to round drilled ports by EMD, on which grommet gaskets are used. It is possible to convert the old style heads and liners to the new style parts, when desirable to do so.

Heads are prepared for "Heliarc" welding by milling or chipping out the water passage ports at an angle of 30 deg. from the inside. A group of heads prepared for welding up the ports are shown in Fig. 7. Cast iron plugs are used at the bottom of the holes which are built up solid by welding using cast iron filler rod.

Liners have water passage ports prepared in much the same manner as

Fig. 6 STAGES IN RECLAMATION of cylinder heads. Starting at left with fully welded head; then one semi-finished; and a fully machined head ready for use.

Fig. 7 UP-DATING BY WELDING is shown. Elongated water passages are beveled for filling with weld deposition for later drilling of new round passages sealed with grommet gaskets.

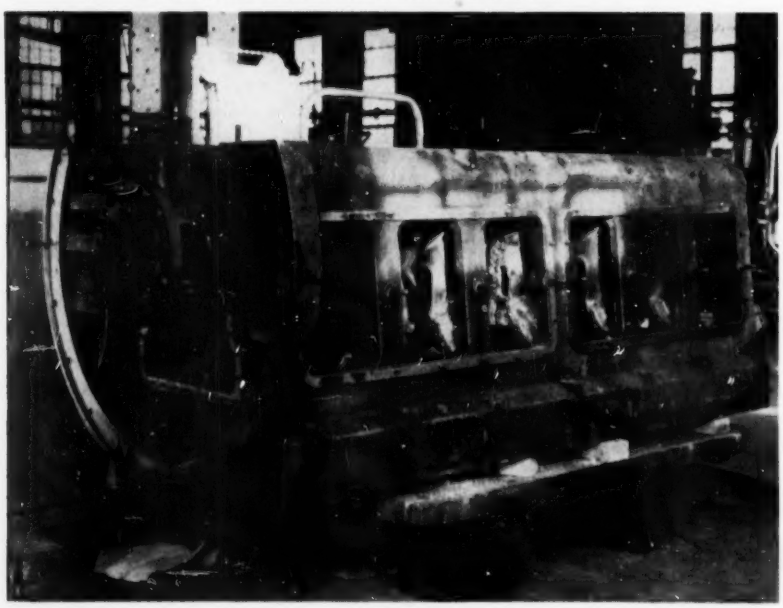
the heads, except that steel plugs are used in the bottom of holes. The holes are then filled in solid using a hard wear-resistant bronze, and the entire contact surface is built up with bronze in one application.

Building up the head contact surface eliminates the "sandwich" type copper-asbestos-steel gasket. In its place a shim type copper gasket is used.

The cost of modification is approximately $10.00 each for either the head or the liner.

SALVAGING—An aluminum motor base was salvaged by an outstanding reclamation job performed in an eastern railroad shop. This was taken from an old 300-hp. diesel locomotive, now obsolete. Welded steel bases are now universally used on locomotive diesel engines. The manufacturer estimated an approximate cost of from $4000 to $5000 to replace this base and delivery would take about 14 to 16 weeks. As the locomotive was badly needed, it was decided to repair the base. "Heliarc" welding was used succesfully at a cost of approximately $145. (Fig. 8)

Fig. 8 SALVAGED ALUMINUM ENGINE BASE reduced cost and time of waiting for new part. Weld area can be seen third crankcase door from left.



"Sigma" Welding

In a new method, the arc is formed between a consumable welding electrode and the work, using argon gas as the shielding medium. In this process the welding rod or filler metal can be supplied in coil form, thus making it possible to make a continuous deposit and also to use automatic machines.

With "Sigma" welding it is now possible to weld aluminum, bronze, and stainless steel at speeds heretofore impossible.

The word "Sigma" is not a trade name. It is now being used as a simple descriptive word in the place of the more cumbersome phrase — "shielded inert gas metal arc".

Summary

Compared with other methods of welding, inert gas shielded arc welding, although of comparatively recent development, has shown great promise for future development and use in fabricating and maintenance.

Some of the applications of this process have been described somewhat at length, with the hope that the methods and equipment shown will suggest new uses not only in the railroad field, but also in many related fields of industry. This method of welding should go far in the years to come.

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SYMBOL MEANINGS

M—Marine
S—Stationary
P—Portable or mobile
O—Own Manufacture
B—American Bosch
BS—Bendix-Scintilla
DM—Demco

A—Air starting
EL—Electric
G—Gasoline engine starting
H—Hand cranking
M—Mechanical blower
TC—Turbocharger

D—Direct reversing
S—Snow-Nabstedt
T—Twin Disc
C—Capitol
P—Paragon
W—Western Gear
F—Falk

American Locomotive Company
30 Church Street
New York, New York

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
9 x 10½	P	4	12	9 x 10½	1600	1000	B	EL	TC	..	..	..	..	..
9 x 10½	P	4	16	9 x 10½	2500	1000	B	EL	TC	..	..	..	..	..
12½ x 13	P	4	6	12½ x 13	660	740	B	EL	..	..	..	..	..	34000
12½ x 13-T	P	4	6	12½ x 13	1000	740	B	EL	TC	..	..	..	..	36000
12½ x 13	S	4	6	12½ x 13	540– 650	600–720	B	A	..	..	..	..	..	39100
12½ x 13	S	4	8	12½ x 13	720– 865	600–720	B	A	..	..	..	..	..	51500
12½ x 13-T	S	4	6	12½ x 13	810– 975	600–720	B	A	TC	..	..	..	..	40600
12½ x 13-T	S	4	8	12½ x 13	1080–1300	600–720	B	A	TC	..	..	..	..	53300

All stationary engines available as dual-fuel units with same ratings.

Baldwin-Lima-Hamilton Corp.
Hamilton, Ohio
Baldwin Engines

Mode.	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
606-NA	M-S-P	4	6	12¾ x 15½	595– 825	450– 625	B-BS	Air*	..	D	159	60	91	28000
608-NA	M-S-P	4	8	12¾ x 15½	720–1000	450– 625	B-BS	Air*	..	D	195	60	91	36000
606-SC	M-S-P	4	6	12¾ x 15½	815–1125	450– 625	B-BS	Air*	TC	D	193	72	91	29000
608-SC	M-S-P	4	8	12¾ x 15½	1080–1500	450– 625	B-BS	Air*	TC	D	232	72	91	37550
706-NA	M-S	4	6	17 x 20	830–1040	300– 375	B-BS	Air	..	D	231	85½	116¾	65100
708-NA	M-S	4	8	17 x 20	1110–1380	300– 375	B-BS	Air	..	D	287	85½	116¾	84000
706-SC	M-S	4	6	17 x 20	1240–1560	300– 375	B-BS	Air	TC	D	259	98⅞	116¾	67000
708-SC	M-S	4	8	17 x 20	1650–2080	300– 375	B-BS	Air	TC	D	315	98⅞	116¾	86000

**Electric starting in locomotive application.*

Hamilton Engines

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
69SA	M-S-P	4	6	9 x 12	330– 450	720– 950	DM	A-EL	..	..	130	50¼	50½	18000
T69SA	M-S-P	4	6	9 x 12	600– 900	720– 950	DM	A-EL	TC	..	134	50¾	50¾	19500
89SA	M-S-P	4	8	9 x 12	450– 600	720– 950	DM	A-EL	..	..	157	50¼	50¾	22000
T89SA	M-S-P	4	8	9 x 12	900– 1200	720– 950	DM	A-EL	TC	..	161	50¼	50¾	24500
521SA	M-S	2	5	21½ x 27½	2400	257	B	A	..	D	267	80	148	170000
621SA	M-S	2	6	21½ x 27½	2900	257	B	A	..	D	304	80	148	200000
721SA	M-S	2	7	21½ x 27½	3400	257	B	A	..	D	341	80	148	228000
821SA	M-S	2	8	21½ x 27½	3850	257	B	A	..	D	378	80	148	256000
921SA	M-S	2	9	21½ x 27½	4350	257	B	A	..	D	415	80	148	285000
1021SA	M-S	2	10	21½ x 27½	4850	257	B	A	..	D	478	80	148	314000
1121SA	M-S	2	11	21½ x 27½	5300	257	B	A	..	D	515	80	148	342000
1221SA	M-S	2	12	21½ x 27½	5800	257	B	A	..	D	552	80	148	370000
324DA	M-S	2	3	24 x 36	1585– 3000	100– 180	O	A	..	D	..	..	..	....
424DA	M-S	2	4	24 x 36	2115– 4000	100– 180	O	A	..	D	310	111	236	.....
524DA	M-S	2	5	24 x 36	2640– 5000	100– 180	O	A	..	D	356	111	236	441000
624DA	M-S	2	6	24 x 36	3170– 6000	100– 180	O	A	..	D	402	111	236	514000
724DA	M-S	2	7	24 x 36	3700– 7000	100– 180	O	A	..	D	447	111	236	588000
824DA	M-S	2	8	24 x 36	4225– 8000	100– 180	O	A	..	D	492	111	236	661000
924DA	M-S	2	9	24 x 36	4750– 9000	100– 180	O	A	..	D	538	111	236	735000
1024DA	M-S	2	10	24 x 36	5280–10000	100– 180	O	A	..	D	583	111	236	808000

The prefix "T" denotes turbocharged engine. The suffix "DA" or "SA" indicates whether the engine is double or single acting. All models are direct reversible except the various executions of the 9SA. All engines are designed with open type combustion chambers. All 21½ x 27½ engines are available as dual-fuel units.

The Buda Company
Harvey, Illinois

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
1BD38	S	4	1	3 7/16 x 4 1/8	6.7	1800	B	EL	..	..	38 1/16	22 15/16	39 1/2	795
2BD77	P	4	2	3 7/16 x 4 1/8	15.8	2000	B	EL	..	..	21 7/16	22 3/4	30 3/4	500
2BD-77	S	4	2	3 7/16 x 4 1/8	13.4	1800	B	EL	..	..	39 13/16	22 15/16	39 13/16	795
2BDM-77	M	4	2	3 7/16 x 4 1/8	15.3	2000	B	EL	..	S	37 9/16	25 1/16	31 3/4	720
4BD-153	P	4	4	3 7/16 x 4 1/8	34	2400	B	EL	..	..	30 5/16	22 3/4	30 3/4	680
4BD-153	S	4	4	3 7/16 x 4 1/8	28	2000	B	EL	..	..	50 11/16	22 15/16	39 13/16	875
4BDM-153	M	4	4	3 7/16 x 4 1/8	33	2400	B	EL	..	S	47 15/16	25 1/16	31 3/4	840
6BD-230	S	4	6	3 7/16 x 4 1/8	42	2000	B	EL	..	..	56 5/16	22 15/16	39 13/16	985
6BD-230	P	4	6	3 7/16 x 4 1/8	52	2400	B	EL	..	..	38 5/16	22 3/4	30 3/4	850
6BDM-230	M	4	6	3 7/16 x 4 1/8	50	2400	B	EL	..	S	56 5/16	25 1/16	31 3/4	1140
4BD-182	P	4	4	3 3/4 x 4 1/8	39	2400	B	EL	..	..	30 5/16	22 3/4	30 3/4	710
4BD-182	S	4	4	3 3/4 x 4 1/8	32	1800	B	EL	..	..	50 11/16	22 15/16	39 13/16	875
4BDM-182	M	4	4	3 3/4 x 4 1/8	38	2400	B	EL	..	S	47 15/16	25 1/16	31 3/4	930
6BD-273	P	4	6	3 3/4 x 4 1/8	65	2400	B	EL	..	..	38 5/16	22 3/4	30 3/4	890
6BD-273	S	4	6	3 3/4 x 4 1/8	50	1800	B	EL	..	..	56 5/16	22 15/16	39 13/16	985
6BDM-273	M	4	6	3 3/4 x 4 1/8	63	2400	B	EL	..	S	56 5/16	25 1/16	31 3/4	1250
6DT-317	S	4	6	3 5/8 x 5 1/8	56	1800	B	EL	..	..	64 19/32	26 3/4	47 9/16	1650
6DT-317	P	4	6	3 5/8 x 5 1/8	79	2300	B	EL	..	..	41 5/8	27 1/16	40 1/16	1150
6DTM-317	M	4	6	3 5/8 x 5 1/8	77	2300	B	EL	..	S	57 7/8	29 1/8	36 3/4	1795
6DT-468	S	4	6	4 1/4 x 5 1/2	76	1600	B	EL	..	..	72 5/32	29 1/8	53 5/8	2235
6DT-468	P	4	6	4 1/4 x 5 1/2	96	2000	B	EL	..	..	48	26 5/8	39 5/16	1245
6DTM-468	M	4	6	4 1/4 x 5 1/2	93	2000	B	EL	..	S	63 7/8	32 5/8	38	2140
6DTS-468	P	4	6	4 1/4 x 5 1/2	135	2400	B	EL	M	..	47 5/16	33 1/16	41 1/8	1565
6DA-779	P	4	6	5 1/4 x 6	165	1900	B	EL	..	..	58 5/8	29 1/16	49	2552
6DA-779	S	4	6	5 1/4 x 6	120	1400	B	EL	..	..	94 3/4	38	64	4505
6DA-844	P	4	6	5 1/4 x 6 1/2	190	1950	B	EL	..	..	58 5/8	29 1/16	49	2630
6DA-844	S	4	6	5 1/4 x 6 1/2	140	1400	B	EL	..	..	94 3/4	38	64	4605
6DAM-844	M	4	6	5 1/4 x 6 1/2	184	1950	B	EL	..	S	77 3/4	30	46 5/8	3700
6DAS-844	S	4	6	5 1/4 x 6 1/2	155	1400	B	EL	M	..	94 3/4	38	64	2895
6DASM-844	M	4	6	5 1/4 x 6 1/2	232	1950	B	EL	M	S	77 3/4	33 7/16	46 5/8	4100
6DAS-844	P	4	6	5 1/4 x 6 1/2	245	1950	B	EL	M	..	58 5/8	34 7/16	48 1/2	2674
8DA-1125	P	4	8	5 1/4 x 6 1/2	250	1950	B	EL	..	..	75 15/16	29 1/16	50 13/16	3400
8DA-1125	S	4	8	5 1/4 x 6 1/2	171	1400	B	EL	..	..	110 1/4	46	73 1/16	5200
8DAM-1125	M	4	8	5 1/4 x 6 1/2	242	1950	B	EL	..	S	96 5/16	29 7/16	46 13/16	4500

(Buda Company Specifications continued on next page)

The Buda Company

(Continued from preceding page)

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Con. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
8DAS-1125	P	4	8	5¼ x 6½	300	1950	B	EL	M	..	78	33 5/16	50 13/16	3580
8DAS-1125	S	4	8	5¼ x 6½	192	1400	B	EL	M	..	114	46	73 5/16	5850
8DASM-1125	M	4	8	5¼ x 6½	290	1950	B	EL	M	S	100 5/16	39 15/16	43 5/16	4900
4DC-645	S	4	6	5⅝ x 6½	97	1400	B	EL	..	..	78½	38	63 3/4	3380
6DC-970	P	4	6	5⅝ x 6½	178	1800	B	EL	..	..	58 5/8	29 5/16	49	2600
6DC-970	S	4	6	5⅝ x 6½	140	1400	B	EL	..	..	94 3/4	38	64	4650
8DC-1290	S	4	8	5⅝ x 6½	190	1400	B	EL	..	..	110 1/8	46	73	5250
8DC-1290	P	4	8	5⅝ x 6½	243	1800	B	EL	..	..	75 15/16	29 5/16	51	3450
6DC-1879	P	4	6	6¾ x 8¾	232	1200	B	A-EL	..	..	95 7/8	53 5/16	64 1/8	6925
6DC-1879	S	4	6	6¾ x 8¾	171	900	B	A-EL	..	..	122	48	85 5/16	8755
6DCM-1879	M	4	6	6¾ x 8¾	225	1200	B	A-EL	..	S	123 1/8	40	64	8350
6DCS-1879	P	4	6	6¾ x 8¾	284	1200	B	A-EL	M	..	99 1/8	53 1/8	64 1/8	7900
6DCSM-1879	M	4	6	6¾ x 8¾	275	1200	B	A-EL	M	S	125 7/8	48	64	8700
8DCM-2505	M	4	8	6¾ x 8¾	325	1200	B	A-EL	..	W	133 1/16	42	66 3/4	12400
8DC-2505	S	4	8	6¾ x 8¾	216	900	B	A-EL	..	..	148 5/16	52	92	12840
8DCS-2505	S	4	8	6¾ x 8¾	320	900	B	A-EL	M	..	157 1/8	63 1/8	91 1/4	13240
8DCSM-2505	M	4	8	6¾ x 8¾	430	1200	B	A-EL	M	W	136 11/16	50 3/4	66 3/4	13800

All engines have Lanova combustion system.

Caterpillar Tractor Co.
Peoria, Illinois

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D397	S-P	4	V-12	5¾ x 8	500	1200	O	A-EL	M	..	113	51	78	11000
D397M	M	4	V-12	5¾ x 8	400	1200	O	A-EL	M	P	148	58	65	14000
D386	S-P	4	V-12	5¾ x 8	400	1200	O	A-EL	..	..	109	51	71	10770
D386M	M	4	V-12	5¾ x 8	320	1200	O	A-EL	..	P	148	58	60	13770
D375	S-P	4	V-8	5¾ x 8	335	1200	O	A-EL	M	..	89	51	78	8550
D375M	M	4	V-8	5¾ x 8	270	1200	O	A-EL	M	S	118	53	69	11350
D364	S-P	4	V-8	5¾ x 8	265	1200	O	A-EL	..	..	89	53	73	8370
D364M	M	4	V-8	5¾ x 8	215	1200	O	A-EL	..	S	118	53	64	11170
D17000	S-P	4	V-8	5¾ x 8	200	1000	O	G-EL-A	..	T	85	50	67	8000
D17000M	M	4	V-8	5¾ x 8	150	1000	O	G-EL-A	..	T	113	53	56	9538
D13000	S-P	4	6	5¾ x 8	150	1000	O	G-EL-A	..	..	85	50	67	5610
D13000M	M	4	6	5¾ x 8	120	1000	O	G-EL-A	..	T-S	120	47	54	7450
D8800	S-P	4	4	5¾ x 8	102	1000	O	G-EL-A	..	..	70	49	67	4600
D8800M	M	4	4	5¾ x 8	82	1000	O	G-EL-A	..	T-S	92	47	51	5530
D337	S-P	4	6	5½ x 6	250	2000	O	G-EL-A	M	..	72	36	57	3950
D326	S-P	4	6	5½ x 6	170	2000	O	G-EL-A	..	..	72	36	52	3850
D318	S-P	4	6	4½ x 5½	103	1600	O	G-EL	..	..	77	31	57	3100
D318M	M	4	6	4½ x 5½	80	1600	O	G-EL	..	T-S	87	35	44	3620
D315	S-P	4	4	4½ x 5½	70	1600	O	G-EL	..	..	60	30	50	2450
D315M	M	4	4	4½ x 5½	53	1600	O	G-EL	..	T-S	70	34	42	2939
D311	S-P	4	4	4 x 5	52	1700	O	G-EL	..	..	58	28	52	1890
D311M	M	4	4	4 x 5	38	1600	O	G-EL	..	T	65	34	38	2500

Marine engine Hp. is for continuous 24-hr. duty. All other hp., max. without radiator fan. Dimensions and weights: Marine engines include reduction and reverse gear. Heights are above propeller shaft. All other engines w/o radiator fan. Weights are approximate. Widths include sump pump handle extended, starting crank, etc. All engines have "Caterpillar" fuel system—solid injection, precombustion chamber type. D397, D375 and D337 equipped with Roots blower. All engines available as "Caterpillar" Electric Sets.

Chicago Pneumatic Tool Co.
6 E. 44th Street
New York, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
39CP	S	4	3	9 x 10½	142.5	720	BS	A	..	..	68	26	67	9590
49CP	S	4	4	9 x 10½	190	720	BS	A	..	..	72	31	67	10690
69CP	S	4	6	9 x 10½	285	720	BS	A	..	..	112	31	67	14240
89CP	S	4	8	9 x 10½	380	720	BS	A	..	..	140	33	67	17880
412CP	S	4	4	11 x 12	332	720	BS	A	..	..	106	47	95	21200
512CP	S	4	5	11 x 12	415	720	BS	A	..	..	124	55	95	25300
612CP	S	4	6	11 x 12	500	720	BS	A	..	..	143	55	95	31600
812CP	S	4	8	11 x 12	665	720	BS	A	..	..	178	68	95	35700
614CP	S	4	6	11 x 14¼	420	514	BS	A	..	..	143	55	95	32000
814CP	S	4	8	11 x 14¼	560	514	BS	A	..	..	178	68	95	36000
460CP	S	4	4	16 x 20	580	360	BS	A	..	..	171	85	125	62700
462CP	S	4	4	16 x 22	580	327	BS	A	..	..	171	85	125	62700
560CP	S	4	5	16 x 20	725	360	BS	A	..	..	197	85	125	70500
562CP	S	4	5	16 x 22	725	327	BS	A	..	..	197	85	125	70500
660CP	S	4	6	16 x 20	875	360	BS	A	..	..	223	85	125	78000
662CP	S	4	6	16 x 22	870	327	BS	A	..	..	223	85	125	78000
860CP	S	4	8	16 x 20	1160	360	BS	A	..	..	275	106	125	98700
862CP	S	4	8	16 x 22	1160	327	BS	A	..	..	275	106	125	98700
69CPS	S	4	6	9 x 10½	428	720	BS	A	TC	..	156	44	84	15740
89CPS	S	4	8	9 x 10½	570	720	BS	A	TC	..	184	58	84	19380
412CPS	S	4	4	11 x 12	500	720	BS	A	TC	..	128	47	113	23400
512CPS	S	4	5	11 x 12	620	720	BS	A	TC	..	146	55	113	27500
612CPS	S	4	6	11 x 12	750	720	BS	A	TC	..	164	55	113	31600
812CPS	S	4	8	11 x 12	1000	720	BS	A	TC	..	215	68	113	35700
614CPS	S	4	6	11 x 14¼	620	514	BS	A	TC	..	164	55	113	32000
814CPS	S	4	8	11 x 14¼	840	514	BS	A	TC	..	215	68	113	36000
460CPS	S	4	4	16 x 20	875	360	BS	A	TC	..	210	85	125	62700
462CPS	S	4	4	16 x 22	820	327	BS	A	TC	..	210	85	125	62700
560CPS	S	4	5	16 x 20	1060	360	BS	A	TC	..	236	106	125	70500
562CPS	S	4	5	16 x 22	1060	327	BS	A	TC	..	236	106	125	72700
660CPS	S	4	6	16 x 20	1310	360	BS	A	TC	..	262	106	125	78000
662CPS	S	4	6	16 x 22	1310	327	BS	A	TC	..	262	106	125	80300
860CPS	S	4	8	16 x 20	1750	360	BS	A	TC	..	320	116	125	98700
862CPS	S	4	8	16 x 22	1750	327	BS	A	TC	..	320	116	125	101200

Engines have open-combustion chamber. Stationary use. All engines can be furnished as dual-fuel units.

Clark Bros. Co., Inc.
Olean, New York

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RAD2	S	2	2	14 x 14	200	330	B-BS	A	..	..	..	..	..	28700
RAD32	S	2	3	14 x 14	300	330	B-BS	A	..	..	..	..	..	33850
RAD4	S	2	4	14 x 14	400	330	B-BS	A	..	..	..	..	..	42700

(Clark Bros. Co. Specifications continued on next page)

Clark Bros. Co., Inc.

(Continued from preceding page)

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RAD5	S	2	5	14 x 14	500	330	B-BS	A	..	..	..	..	..	52700
RAD6	S	2	6	14 x 14	600	330	B-BS	A	..	..	..	..	..	65550
RAD8	S	2	8	14 x 14	800	330	B-BS	A	..	..	..	..	..	70400
DG4	S	2	4	12½ x 16	380- 500	300- 400	B-BS	A	..	..	..	..	..	.....
DG5	S	2	5	12½ x 16	475- 675	300- 400	B-BS	A	..	..	..	..	..	.....
DG6	S	2	6	12½ x 16	570- 750	300- 400	B-BS	A	..	..	..	..	..	.....
DG8	S	2	8	12½ x 16	760-1000	300- 400	B-BS	A	..	..	..	..	..	.....
MD4	M	2	4	12½ x 16	400	315	B-BS	A	..	..	..	..	..	42000
MD6	M	2	6	12½ x 16	600	315	B-BS	A	..	..	..	..	..	56000

All engines have open type combustion chambers.

Climax Engine & Pump Mfg. Co.
Clinton, Iowa

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-148	S	4	2	4¼ x 5¼	18	1200	B	EL	..	..	32	26	44	1950
D-297	S	4	4	4¾ x 5¼	36	1200	B	EL	..	..	47	26	44	2950

Stationary use.

Continental Motors Corp.
Muskegon, Mich.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
GD-157	S	4	4	3⅛ x 4⅛	37.5	2000	B	EL	..	..	31⅛	15¾	30¼	605
HD-260	S	4	4	3⅞ x 5½	57	2000	B	EL	..	..	33⅛	21¾	35	840
TD-427	S	4	6	4⅛ x 4⅞	102	2000	B	EL	..	..	47⅛	21¾	37½	1300
RD-572	S	4	6	4¾ x 5⅝	137	2000	B	EL	..	..	51⅛	28	44⅝	1845
TD-642I	P	4	6	4⅛ x 4⅞	112	2400	B	EL	..	..	46¾	20½	36⅛	1270
RD-657Z	P	4	6	4¾ x 5⅝	150	2200	B	EL	..	..	52⅛	20½	41⅝	1785

Models designated for portable use are transportation engines. All others are industrial or agricultural except HD-260 which is industrial only. Ratings given are bare engine hp.

Cooper-Bessemer Corp.
Mount Vernon, Ohio

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
FW6	S	4	6	9 x 10½	430	1000	BS	A	..	..	130	34¾	80	17800
FW6T	S	4	6	9 x 10½	835	1000	BS	A	TC	..	176	34¾	80	18300
FV8	S	4	8	9 x 10½	575	1000	BS	A	..	..	102	43⅛	57⅜	22000
FV8T	S	4	8	9 x 10½	1110	1000	BS	A	TC	..	124	43⅛	57⅜	27240
FV12	S	4	12	9 x 10½	860	1000	BS	A	..	..	140	43⅛	57⅜	26000
FV12T	S	4	12	9 x 10½	1670	1000	BS	A	TC	..	140	43⅛	57⅜	37880
FV16	S	4	16	9 x 10½	1150	1000	BS	A	..	..	165	43⅛	57⅜	32000
FV16T	S	4	16	9 x 10½	2230	1000	BS	A	TC	..	165	43⅛	57⅜	46430
GS6	S	4	6	10½ x 13½	565	750	O	A	..	..	142½	37½	67¼	21500
GS6T	S	4	6	10½ x 13½	895	750	O	A	TC	..	174	37½	67¼	22250
GS8	S	4	8	10½ x 13½	755	750	O	A	..	..	175	37½	67¼	29500
GS8T	S	4	8	10½ x 13½	1195	750	O	A	TC	..	206½	37½	67¼	30250
JS5	S	4	5	13 x 16	515	450	O	A	..	..	149	44¾	79⅝	41000
JS6	S	4	6	13 x 16	705	514	O	A	..	..	171	44¾	79⅝	44000
JS6T	S	4	6	13 x 16	1115	514	O	A	TC	..	199½	44¼	79⅝	45000
JS7	S	4	7	13 x 16	820	514	O	A	..	..	193	44¼	79⅝	48000
JS7T	S	4	7	13 x 16	1300	514	O	A	TC	..	221	44¼	79⅝	49000
JS8	S	4	8	13 x 16	935	514	O	A	..	..	210	44¾	79⅝	51000
JS8T	S	4	8	13 x 16	1485	514	O	A	TC	..	238½	44¾	79⅝	52000
LS6	S	4	6	15½ x 22	965	360	O	A	..	..	224	55⅝	120	76000
LS6T	S	4	6	15½ x 22	1530	360	O	A	TC	..	251	55⅝	120	77000
LS7	S	4	7	15½ x 22	1125	360	O	A	..	..	248	55⅝	120	91000
LS7T	S	4	7	15½ x 22	1785	360	O	A	TC	..	270	55⅝	120	92000
LS8	S	4	8	15½ x 22	1285	360	O	A	..	..	276	55⅝	120	106000
LS8T	S	4	8	15½ x 22	2040	360	O	A	TC	..	299	55⅝	120	107000
LSV12	S	4	12	15½ x 22	1925	360	O	A	..	..	252	68	117	194500
LSV12T	S	4	12	15½ x 22	3060	360	O	A	TC	..	300	68	117	197500
LSV16	S	4	16	15½ x 22	2565	360	O	A	..	..	307	68	117	232500
LSV16T	S	4	16	15½ x 22	4080	360	O	A	TC	..	355	68	117	237500
FW6MG	M	4	6	9 x 10½	430	1000	BS	A	..	O	171	43⅛	57⅜	19500
FW6MGT	M	4	6	9 x 10½	835	1000	BS	A	TC	O	171	43⅛	57⅜	20000
FV8MG	M	4	8	9 x 10½	575	1000	BS	A	..	O	186	43⅛	57⅜	23000
FV8MGT	M	4	8	9 x 10½	1110	1000	BS	A	TC	O	186	43⅛	57⅜	23000
FV12MG	M	4	12	9 x 10½	860	1000	BS	A	..	O	220	43⅛	57⅜	29300
FV12MGT	M	4	12	9 x 10½	1670	1000	BS	A	TC	O	255	43⅛	57⅜	30000
FV16MG	M	4	16	9 x 10½	1150	1000	BS	A	..	O	262	43⅛	57⅜	35500
FV16MGT	M	4	16	9 x 10½	2230	1000	BS	A	TC	O	303	43⅛	57⅜	36500
GS6DR	M	4	6	10½ x 13½	565	750	O	A	..	D	175	37½	67¼	34000
GS6DRT	M	4	6	10½ x 13½	895	750	O	A	TC	D	178	37½	67¼	36000
GS8DR	M	4	8	10½ x 13½	755	750	O	A	..	D	208	37½	67¼	42000
GS8DRT	M	4	8	10½ x 13½	1195	750	O	A	TC	D	210	37½	67¼	44000
JS6DR	M	4	6	13 x 16	705	514	O	A	..	D	177	44¼	79⅝	46000
JS6DRT	M	4	6	13 x 16	1115	514	O	A	TC	D	177	44¼	79⅝	50000
JS8DR	M	4	8	13 x 16	935	514	O	A	..	D	216	44¼	79⅝	55000
JS8DRT	M	4	8	13 x 16	1485	514	O	A	TC	D	216	44¼	79⅝	60000
LS6DR	M	4	6	15½ x 22	965	360	O	A	..	D	239	55⅝	120	90000
LS6DRT	M	4	6	15½ x 22	1530	360	O	A	TC	D	239	55⅝	120	91000
LS8DR	M	4	8	15½ x 22	1285	360	O	A	..	D	287	55⅝	120	110000
LS8DRT	M	4	8	15½ x 22	2040	360	O	A	TC	D	287	55⅝	120	111000
LSV12DR	M	4	12	15½ x 22	1925	360	O	A	..	D	243	68	117	190000
LSV12DRT	M	4	12	15½ x 22	3060	360	O	A	TC	D	263	68	117	191000
LSV16DR	M	4	16	15½ x 22	2565	360	O	A	..	D	298	68	117	217000
LSV16DRT	M	4	16	15½ x 22	4080	360	O	A	TC	D	341	68	117	219000

Engines have open combustion chamber. Models marked M for marine use only; all others can be furnished for either straight diesel or dual-fuel operation. All stationary models FV, FW are available also as gas engines and gas-diesels. Width is between bolt centers. Height is given above shaft.

Cummins Engine Company, Inc.
Columbus, Indiana

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
A-600	M-S-P	4	6	4 x 5	100	2200	O	EL	..	T	48	27	37	1440†
HR400	M-S-P	4	4	5½ x 6	110	1800	O	EL	..	T	42	30	47	1640†
JBS-600	P	4	6	4½ x 5	150	2500	O	EL	M	..	47	25	40	1545†
H600	M-S-P	4	6	4⅞ x 6	150	1800	O	EL	..	T	57	30	46	2395†
HR600	M-S-P	4	6	5¼ x 6	165	1800	O	EL	..	T	57	30	46	2400†
HRBB-600	P	4	6	5⅛ x 6	175	2000	O	EL	..	..	61	30	49	2450†
HS600	S-P	4	6	4⅞ x 6	200	1800	O	EL	M	T	58	32	47	2580†
NH600	M-S-P	4	6	5⅛ x 6	200	2100	O	EL	..	T	59	41	63	2480†
NHH600	P	4	6	5⅛ x 6	200	2100	O	EL	..	..	64	55	23	2285†
HRS600	M-S-P	4	6	5⅛ x 6	225	1800	O	EL	M	T	58	32	47	2580†
NHS600	M-S-P	4	6	5⅛ x 6	275	2100	O	EL	M	C	59	41	61	2775
NHRS600	M-S-P	4	6	5⅛ x 6	300	2100	O	EL	M	C	59	41	61	2725†
NHHS600	P	4	6	5⅛ x 6	275	2100	O	EL	M	..	64	55	23	2580†
NVH1200	M-S-P	4	12	5⅛ x 6	400	2100	O	EL	..	S	73	41	55	4300†
NVHS1200	M-S-P	4	12	5⅛ x 6	550	2100	O	EL	M	S	73	42	55	4550†
L600	M-S	4	6	7 x 10	250	1000	O	A-EL	..	C	92	44	58	7590*
LR600	M-S	4	6	7 x 10	300	1100	O	A-EL	..	C	92	44	58	7590*

*All engines have exclusive Cummins fuel system. All except, L-600 and LR-600 suitable for automotive and other portable applications. † Automotive weight with all accessory equipment; also approx. weight of stationary engine w/o radiator or clutch; and approx. weight of marine engine w/o reverse gear. * Stationary engine and approx. marine weight w/o reverse gear. H.p. ratings and rpm. are maximum ratings.*

Enterprise Engine & Foundry Co.
18th & Florida Streets
San Francisco, Calif.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DM3	M-S	4	3	8 x 10	68– 120	450–700	BS	A-EL	..	RR	54¾†– 91⅛*	42½†	71¾†	5500†– 7200*
DM4	M-S	4	4	8 x 10	90– 160	450–700	BS	A-EL	..	RR	66¾†–107⅝*	42½†	71¾†	6520†– 8200*
DM6	M-S	4	6	8 x 10	135– 240	450–700	BS	A-EL	..	RR	90¾†–131⅝*	42½†	71¾†	8000†–10400*
DM36	M-S	4	6	8 x 10	275– 400	600–750	BS	A-EL	TC	RR	90¾†–131⅝*	42½†	71¾†	9000†–11400*
DG6	M-S	4	6	12 x 15	273– 655	250–600	BS	A	..	D	148½†–189¾*	46¼†	95⅛†	32000†–34500*
DG36	M-S	4	6	12 x 15	434–1041	250–600	BS	A	TC	D	148½†–189¾*	46¼†	95⅛†	33500†–36000*
DG8	M-S	4	8	12 x 15	364– 874	250–600	BS	A	..	D	182½†–223¾*	46¼†	95⅛†	42800†–45000*
DG38	M-S	4	8	12 x 15	578–1388	250–600	BS	A	TC	D	182½†–223¾*	46¼†	95⅛†	44500†–47000*
DQ6	M-S	4	6	16 x 20	647– 932	250–360	BS	A	..	D	192½†–250*	60†	124†	77000†–79000*
DQ36	M-S	4	6	16 x 20	1028–1481	250–360	BS	A	TC	D	192½†–250*	60†	124†	79000†–81000*
DQ8	M-S	4	8	16 x 20	863–1243	250–360	BS	A	..	D	240½†–306*	60†	124†	91000†–94000*
DQ38	M-S	4	8	16 x 20	1371–1974	250–360	BS	A	TC	D	240½†–306*	60†	124†	94000†–97000*

*Engines have open combustion chamber. † Stationary. * Marine including reverse-reduction gear. On DM series add 4½ in. for marine width and subtract 4 in. for marine height. RR—Reverse and reduction gear—make varies.*

Fairbanks, Morse & Company
600 S. Michigan Avenue
Chicago, Ill.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
31A6¼	M-S-P	2	5	6¼ x 9	150	720	O	A	..	D	..	..	..	..
31A6¼	M-S-P	2	6	6¼ x 9	180	720	O	A	..	D	..	..	..	..
31A6¼	M-S-P	2	7	6¼ x 9	210	720	O	A	..	D	..	..	..	..
31A6¼	M-S-P	2	8	6¼ x 9	240	720	O	A	..	D	..	..	..	..
31A8½	S-P	2	5	8½ x 11½	300	514	O	A	..	..	..	..	..	..
31A8½	S-P	2	6	8½ x 11½	360	514	O	A	..	..	..	..	..	..
31A8½	S-P	2	7	8½ x 11½	420	514	O	A	..	..	..	..	..	..
31A8½	S-P	2	8	8½ x 11½	480	514	O	A	..	..	..	..	..	..
31A8½	M	2	5	8½ x 11½	275	525	O	A	..	D	..	..	..	..
31A8½	M	2	6	8½ x 11½	330	525	O	A	..	D	..	..	..	..
31A8½	M	2	7	8½ x 11½	385	525	O	A	..	D	..	..	..	..
31A8½	M	2	8	8½ x 11½	440	525	O	A	..	D	..	..	..	..
31A18	S	2	6	18 x 27	2100	277	O	A	..	..	..	..	..	..
31A18	S	2	8	18 x 27	2800	277	O	A	..	..	..	..	..	..
31A18	S	2	10	18 x 27	3500	277	O	A	..	..	..	..	..	..
32E12	S	2	2	12 x 15	120	360	O	A	..	..	..	..	..	..
32E12	S	2	3	12 x 15	180	360	O	A	..	..	..	..	..	..
32E14	S	2	2	14 x 17	150	300	O	A	..	..	..	..	..	..
32E14	S	2	3	14 x 17	225	300	O	A	..	..	..	..	..	..
32E14	S	2	4	14 x 17	300	300	O	A	..	..	..	..	..	..
32E14	S	2	5	14 x 17	375	300	O	A	..	..	..	..	..	..
32E14	S	2	6	14 x 17	450	300	O	A	..	..	..	..	..	..
33F12	S	2	5	12 x 15	500	400	O	A	..	..	..	..	..	..
33F12	S	2	6	12 x 15	600	400	O	A	..	..	..	..	..	..
33E14	S	2	5	14 x 17	575	300	O	A	..	..	..	..	..	..
33E14	S	2	6	14 x 17	690	300	O	A	..	..	..	..	..	..
33E14	S	2	7	14 x 17	805	300	O	A	..	..	..	..	..	..
33F16	S	2	4	16 x 20	800	300	O	A	..	..	..	..	..	..
33F16	S	2	5	16 x 20	1000	300	O	A	..	..	..	..	..	..
33F16	S	2	6	16 x 20	1200	300	O	A	..	..	..	..	..	..
33F16	S	2	7	16 x 20	1400	300	O	A	..	..	..	..	..	..
33F16	S	2	8	16 x 20	1600	300	O	A	..	..	..	..	..	..
33F16	S	2	10	16 x 20	2000	300	O	A	..	..	..	..	..	..
37F12	M	2	5	12 x 15	500	400	O	A	..	D	..	..	..	..
37F12	M	2	6	12 x 15	600	400	O	A	..	D	..	..	..	..
37E14	M	2	5	14 x 17	575	300	O	A	..	D	..	..	..	..
37E14	M	2	6	14 x 17	690	300	O	A	..	D	..	..	..	..
37E14	M	2	7	14 x 17	805	300	O	A	..	D	..	..	..	..
37F16	M	2	5	16 x 20	1000	300	O	A	..	D	..	..	..	..
37F16	M	2	6	16 x 20	1200	300	O	A	..	D	..	..	..	..
37F16	M	2	7	16 x 20	1400	300	O	A	..	D	..	..	..	..
37F16	M	2	8	16 x 20	1600	300	O	A	..	D	..	..	..	..
37F16	M	2	10	16 x 20	2125	300	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	4	8⅛ x 10	640	720	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	5	8⅛ x 10	800	720	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	6	8⅛ x 10	960	720	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	8	8⅛ x 10	1280	720	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	10	8⅛ x 10	1600	720	O	A	..	D	..	..	..	..
38D8⅛	M-S-P	2	12	8⅛ x 10	1920	720	O	A	..	D	..	..	..	..
45B3⅛	M-S-P	4	1	3⅛ x 4	5¼	1800	DM	H-EL	..	..	..	..	..	..
45B4⅛	M-S-P	4	1	4⅛ x 4½	10½	1800	DM	H-EL	..	..	..	..	..	..
48A3	M-S-P	4	1	3 x 4	3½	1800	O	H-EL	..	S-T	..	..	..	..
48A4	M-S-P	4	1	4 x 5	10	1800	O	H-EL	..	S-T	..	..	..	..
48A4¼	M-S-P	4	1	4¼ x 5	11	1800	O	H-EL	..	S-T	..	..	..	..
48A4	M-S-P	4	2	4 x 5	20	1800	O	H-EL	..	S-T	..	..	..	..

(Fairbanks-Morse Specifications continued on next page)

Fairbanks, Morse & Company

(Continued from preceding page)

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weigh Lb.
48A4¼	M-S-P	4	2	4¼ x 5	22	1800	O	H-EL	..	S-T	..	..	..	..
48A4	M-S-P	4	3	4 x 5	30	1800	O	H-EL	..	S-T	..	..	..	..
48A4¼	M-S-P	4	3	4¼ x 5	34	1800	O	H-EL	..	S-T	..	..	..	..
48A4	M-S-P	4	6	4 x 5	61	1800	O	EL	..	S-T	..	..	..	..
48A4¼	M-S-P	4	6	4¼ x 5	67	1800	O	EL	..	S-T	..	..	..	..
49A4½	M-S-P	2	2	4½ x 5½	40	1200	B-BS	EL	..	S-T	..	..	..	..
49A4½	M-S-P	2	3	4½ x 5½	60	1200	B-BS	EL	..	S-T	..	..	..	..
49A4½	M-S-P	2	4	4½ x 5½	80	1200	B-BS	EL	..	S-T	..	..	..	..
49A4½	M-S-P	2	6	4½ x 5½	120	1200	B-BS	EL	..	S-T	..	..	..	..

Engines have open combustion chamber. Models 38D are oppused-piston type.

Fulton Iron Works Company
St. Louis, Missouri

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
BGS	S	4	5	17½ x 24½	765	257	O	A	..	..	..	..	..	104000
BGS	S	4	5	17½ x 24½	825	277	O	A	..	..	..	..	..	104000
BGSS	S	4	5	17½ x 24½	1145	257	O	A	TC	..	..	..	..	106000
BGSS	S	4	5	17½ x 24½	1235	277	O	A	TC	..	..	..	..	106000
BGS	S	4	6	17½ x 24½	915	257	O	A	..	..	..	..	..	121280
BGS	S	4	6	17½ x 24½	990	277	O	A	..	..	..	..	..	121280
BGSS	S	4	6	17½ x 24½	1375	257	O	A	TC	..	..	..	..	123300
BGSS	S	4	6	17½ x 24½	1480	277	O	A	TC	..	..	..	..	123300
BGS	S	4	7	17½ x 24½	1070	257	O	A	..	..	..	..	..	138650
BGS	S	4	7	17½ x 24½	1155	277	O	A	..	..	..	..	..	138650
BGSS	S	4	7	17½ x 24½	1600	257	O	A	TC	..	..	..	..	141500
BGSS	S	4	7	17½ x 24½	1730	277	O	A	TC	..	..	..	..	141500
BGS	S	4	8	17½ x 24½	1220	257	O	A	..	..	..	..	..	156930
BGS	S	4	8	17½ x 24½	1320	277	O	A	..	..	..	..	..	156930
BGSS	S	4	8	17½ x 24½	1830	257	O	A	TC	..	..	..	..	160000
BGSS	S	4	8	17½ x 24½	1980	277	O	A	TC	..	..	..	..	160000
KS	S	4	6	24 x 28	1725	225	O	A	..	..	..	..	..	220000
KS	S	4	6	24 x 28	1970	257	O	A	..	..	..	..	..	220000
KS	S	4	6	24 x 28	2590	225	O	A	TC	..	..	..	..	222000
KS	S	4	6	24 x 28	2960	257	O	A	TC	..	..	..	..	222000
KSS	S	4	8	24 x 28	2300	225	O	A	..	..	..	..	..	280000
KSS	S	4	8	24 x 28	2630	257	O	A	..	..	..	..	..	280000
KSS	S	4	8	24 x 28	3455	225	O	A	TC	..	..	..	..	282000
KSS	S	4	8	24 x 28	3945	257	O	A	TC	..	..	..	..	282000

Normally aspirated engines are designated BGS and KS types. Supercharged engines are designated BGSS and KSS types. Dual-fuel normally aspirated engines are designated BGSD and KSD types. Dual-fuel supercharged engines are designated BGSSD and KSSD types.

General Motors Corporation
Cleveland Diesel Engine Division
Cleveland, Ohio

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3-268A*	S-M	2	3	6½ x 7	(100kw*)	1200	O	EL	..	..	104	39¾	64⅜	8050*
4-268A†	S-M	2	4	6½ x 7	250	1300	O	EL-A	..	..	132	39	64⅞	10160†
4-268A*	S-M	2	4	6½ x 7	(150 kw*)	1200	O	EL	..	..	120	39¾	64⅜	10500*
6-268A†	S-M	2	6	6½ x 7	375	1300	O	EL-A	..	..	156	39	63⅞	11300†
6-268A*	S-M	2	6	6½ x 7	(200 kw*)	1200	O	EL	..	..	152	42	74	14470*
8-268A†	S-M	2	8	6½ x 7	500	1300	O	EL-A	..	..	181⅝	41	66	14050†
8-268A*	S-M	2	8	6½ x 7	(300 kw*)	1200	O	EL	..	..	174	46	74	17020*
6-278A†	S-M	2	6	8¾ x 10½	615	750	O	EL-A	..	..	172¾	63⅜	88¾	25700†
6-278A*	S-M	2	6	8¾ x 10½	(400 kw*)	750	O	EL	..	..	159	53	97¾	27400*
8-278A†	S-M	2	8	8¾ x 10½	820	750	O	EL-A	..	..	193	63¾	91	30200†
8-278A*	S-M	2	8	8¾ x 10½	(500 kw*)	750	O	EL	..	..	183	53	97¾	32600*
12-278A†	S-M	2	12	8¾ x 10½	1230	750	O	EL-A	..	..	258	63⅜	101⅞	42100†
12-278A*	S-M	2	12	8¾ x 10½	(750 kw*)	750	O	EL	..	..	224	60	107⅞	42000*
16-278A†	S-M	2	16	8¾ x 10½	1640	750	O	EL-A	..	..	312	69	106⅜	56800†
16-278A*	S-M	2	16	8¾ x 10½	(1000 kw*)	750	O	EL	..	..	279	77	107⅞	52300*

**Entries so marked refer to models supplied as D.C. generating sets, in which cases ratings under column "Cont. H.P." is given in kilowatts and weights are for entire generating set assembly.*
†Entries so marked refer to models supplied as propulsion engines, in which cases weights include reverse and reduction gearings. Heights—above shaft ctr.

General Motors Corporation
Detroit Diesel Engine Division
Detroit, Michigan

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2-71	M*	2	2	4¼ x 5	54	2000	O	EL	M[1]	S	51	30	37	1300
2-71	M†	2	2	4¼ x 5	47	1800	O	EL	M[1]	S	51	30	37	1300
2-71	S-P	2	2	4¼ x 5	65**	2000	O	EL	M[1]	..	31	27⅝	35⅜	960
3-7*	M*	2	3	4¼ x 5	96	2000	O	EL	M[1]	O	56¼	32¹¹⁄₁₆	40¼	2020
3-7.	M†	2	3	4¼ x 5	68	1800	O	EL	M[1]	O	56¼	32¹¹⁄₁₆	40¼	2020
3-71	S-P	2	3	4¼ x 5	100**	2000	O	EL	M[1]	..	37⅛	29½	39⅝	1480
4-71	M*	2	4	4¼ x 5	129	2000	O	EL	M[1]	O	62	33¼	40¼	2410
4-71	M†	2	4	4¼ x 5	92	1800	O	EL	M[1]	O	62	33¼	40¼	2410
4-71	S-P	2	4	4¼ x 5	133**	2000	O	EL	M[1]	..	42⅞	29½	40⅝	1720
6-71	M*	2	6	4¼ x 5	195	2000	O	EL	M[1]	O	73⅝	33½	40¼	2645
6-71	M†	2	6	4¼ x 5	140	1800	O	EL	M[1]	O	73⅝	33½	40¼	2645
6-71	S-P	2	6	4¼ x 5	200**	2000	O	EL	M[1]	..	54⅞	29½	41¼	2100
Twin 4	S-P	2	8	4¼ x 5	267**	2000	O	EL	M[1]	..	69⅛	56	58	4700
Twin 6	M*	2	12	4¼ x 5	390	2000	O	EL	M[1]	O	75½	56	56⅝	6400
Twin 6	M†	2	12	4¼ x 5	280	1800	O	EL	M[1]	O	79½	56	56⅜	6400
Twin 6	S-P	2	12	4¼ x 5	400**	2000	O	EL	M[1]	..	79¾	56	58	5440
Tandem Twin 6	M*	2	12	4¼ x 5	390	2000	O	EL	M[1]	O	129	37¼	57	7550
Tandem Twin 6	M†	2	12	4¼ x 5	280	1800	O	EL	M[1]	O	129	37¼	57	7550
Quad 6	M*	2	24	4¼ x 5	780	2000	O	EL	M[1]	O	128	56	54⅛	12600
Quad 6	M†	2	24	4¼ x 5	560	1800	O	EL	M[1]	O	128	56	54⅛	12600
Quad 6	S-P	2	24	4¼ x 5	800**	2000	O	EL	M[1]	..	174	56⅞	68⅛	12065
6-110	M*	2	6	5 x 5.6	265	1800	O	EL	M[1]	O	79¼	31	47⅞	4000
6-110	M†	2	6	5 x 5.6	230	1600	O	EL	M[1]	O	79¼	31	47⅞	4000
6-110	S-P	2	6	5 x 5.6	275**	1800	O	EL	M[1]	..	69¼	31¼	49	4000

** Pleasure craft: Rated SHP. † Work boat: Continuous ship. ** Rated BHP. basic engine. Weights and dimensions of marine engines vary with gear selected. Industrial engines available with torque converters. [1] Pressure scavenging.*

General Motors Corporation
Electro-Motive Division
La Grange, Ill.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-567A	P	2	6	8 1/16 x 10	600	800	O	EL	..	..	115 5/16	64 3/16	84 1/16	15000
8-567B	P	2	8	8 1/16 x 10	800	800	O	EL	..	..	139 1/16	62 5/16	92	17500
12-567B	P	2	12	8 1/16 x 10	1200	800	O	EL	..	..	190 7/16	64 1/16	90	23500
12-567B	P	2	12	8 1/16 x 10	1125	800	O	EL	..	..	174 1/16	64 1/16	90	23500
16-567B	P	2	16	8 1/16 x 10	1500	800	O	EL	..	..	212 1/16	62 5/16	88	30000

Engines are available for marine and industrial use through Cleveland Diesel Engine Division, G.M.C. All engines have open type combustion chambers.

Gray Marine Motor Company
687 Canton Avenue
Detroit 7, Michigan

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-157	M	4	4	3 5/16 x 4 3/16	30	1800	B	EL	..	T	47	22	26*	1100
D-260	M	4	4	3 7/8 x 5 1/2	50	1800	B	EL	..	T	52	22	31 1/2*	1400
D-427	M	4	6	4 1/8 x 4 7/8	100	2200	B	EL	..	P	69	29	27*	1600
D-572	M	4	6	4 3/4 x 5 3/4	135	2200	B	EL	..	T	78	27	28 3/4*	2700

*Engines have dyna-cell combustion systems. Marine use only. Horsepower ratings are maximum. *Height above prop. shaft center line.*

Hallett Manufacturing Co.
1601 W. Florence Ave.
Inglewood, Calif.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AC1	S	4	1	3 1/2 x 3 1/2	5	1800	B	H-EL*	..	..	26 1/2	18	24	220
D-1A	S	4	1	3 7/8 x 4 1/2	8	1500	B	H-EL*	..	..	24	20	30	450
D-2S	S	4	2	3 7/8 x 4 1/2	18	1500	B	EL	..	..	31 1/2	23	31 1/2	566
D-1M	M	4	1	3 7/8 x 4 1/2	8	1500	B	H-EL*	..	..	37 1/2	23	30	630
D-2MS	M	4	2	3 7/8 x 4 1/2	18	1500	B	EL	..	..	49	23	31 1/2	760

*Engines have open combustion chamber. * Model designation refers to hand starting. "S" is added to designation to indicate electric starting.*

Harnischfeger Corporation, P & H Diesel Division
100 Lake Street
Port Washington, Wisconsin

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
187C	M-P	2	1	4 1/2 x 5 1/2	22	1400	BS-B-DM	EL	M	S-T-W	25 1/8	28 1/4	40 1/8	845-1180*
287C	M-P	2	2	4 1/2 x 5 1/2	44	1400	BS-B-DM	EL	M	S-T-W	32 1/8	28 1/4	40 1/8	1030-1350*
387C	M-P	2	3	4 1/2 x 5 1/2	66	1400	BS-B-DM	EL	M	S-T-W	38 7/8	28 1/4	40 1/8	1350-1775*
487C	M-P	2	4	4 1/2 x 5 1/2	88	1400	BS-B-DM	EL	M	S-T-W	45 5/8	28 1/4	40 1/8	1530-2175*
687C	M-P	2	6	4 1/2 x 5 1/2	138	1400	BS-B-DM	EL	M	S-T-W	59 1/8	28 1/4	40 1/8	1900-2950*

Weights shown are approximate for complete marine units including all accessories.

Hercules Motors Corp.
Canton, Ohio

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DIXC	M-S-P	4	2	4 x 4 1/2	27.6	1800	B	EL	..	..	19 1/8	19 1/4	21	550
DIXD	M-S-P	4	2	4 1/4 x 4 1/2	30	1800	B	EL	..	..	19 1/8	19 1/4	21	550
DIX4B	M-S-P	4	4	3 1/4 x 4	40	2200	B	EL	..	..	26 1/8	21 11/16	19	550
DIX4D	M-S-P	4	4	3 1/4 x 4	48.5	2200	B	EL	..	..	26 1/8	21 11/16	19	550
DOOB	M-S-P	4	4	3 3/4 x 4 1/2	48	1800	B	EL	..	..	29 1/8	22 7/8	19 1/4	750
DOOC	M-S-P	4	4	4 x 4 1/2	55	1800	B	EL	..	..	29 1/8	22 7/8	19 1/4	750
DOOD	M-S-P	4	4	4 1/4 x 4 1/2	61.5	1800	B	EL	..	..	29 1/8	22 7/8	19 3/4	750
DIX6D	M-S-P	4	6	3 1/4 x 4	77.5	2200	B	EL	..	..	35 1/4	21 11/16	19	750
DJXB	M-S-P	4	6	3 1/2 x 4 1/2	60	1800	B	EL	..	..	36 1/8	20 1/16	20 1/16	950
DJXC	M-S-P	4	6	3 3/4 x 4 1/2	69	1800	B	EL	..	..	36 1/8	20 1/16	20 1/16	950
DJXH	M-S-P	4	6	3 3/4 x 4 1/2	79	1800	B	EL	..	..	36 1/8	20 1/16	21	950
DJXHF	M-S-P	4	6	3 3/4 x 4 1/2	79	1800	B	EL	..	..	38 3/8	34	13x10 7/16	950
DWXC	M-S-P	4	6	4 x 4 3/4	94	1800	B	EL	..	..	40 3/8	24	24	1350
DWXD	M-S-P	4	6	4 1/4 x 4 3/4	107	1800	B	EL	..	..	40 3/8	24	24	1350
DWXLD	M-S-P	4	6	4 1/4 x 5	112	1800	B	EL	..	..	40 3/8	24	24 1/16	1350
DWXLDP	M-S-P	4	6	4 1/4 x 5	106	1800	B	EL	..	..	37	36 5/16	8 3/4x9	1376
DRXB	M-S-P	4	6	4 5/8 x 5 1/4	103	1600	B	EL	..	..	44 3/8	25 1/16	24 7/16	1600
DRXC	M-S-P	4	6	4 5/8 x 5 1/4	118	1600	B	EL	..	..	44 3/8	25 1/16	24 7/16	1600
DPXB	M-S-P	4	6	5 x 6	160	1600	B	EL	..	..	55 1/16	29 1/16	30 1/16	2500
DPXC	M-S-P	4	6	5 1/4 x 6	176	1600	B	EL	..	..	55 1/16	29 1/16	30 1/16	2500
DPXD	M-S-P	4	6	5 1/2 x 6	191	1600	B	EL	..	..	55 1/16	29 1/16	30 1/16	2500
DPXE	M-S-P	4	6	5 3/4 x 6	199	1600	B	EL	..	..	55 1/16	29 1/16	30 1/16	2500
DPXH	M-S-P	4	6	5 3/4 x 6	220	1600	B	EL	..	..	58 1/16	29 1/16	31 1/16	2575
DPXHF	M-S-P	4	6	5 3/4 x 6	220	1600	B	EL	..	..	50 3/16	47 1/16	17 1/4x14 3/4	2575
DNX-V-8C	M-S-P	4	8	6 x 6	298	1600	B	EL	..	..	51 1/16	42	31 3/16	4200
DNX-V-8D	M-S-P	4	8	6 1/4 x 6	325	1600	B	EL	..	..	51 1/16	42	31 3/16	4200
DNX-V-8DS	M-S-P	4	8	6 1/4 x 6	405	1600	B	EL	M	..	51 1/16	42	31 3/16	4600

Engines have turbulence-chamber combustion system. All models suitable for marine, stationary or mobile use. Lengths are measured from bellhousing face to front support. Heights are measured from crankshaft to top of cylinder head cover. Weights are approximate and include engine with fuel handling equipment only and no other accessories not forming an integral part of the engine. Various mounting arrangements, flywheel housings, oil pans, manifolds, starting motor and generator locations are available to meet specific applications requirements.

Hill Diesel Engine Corporation
238 Mill Street
Lansing 3, Michigan

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2R	M-S	4	2	3½ x 5½	9-17	800-1600	B	EL	..	S	50	32	47	1515
4R	M-S	4	4	3½ x 5½	18-34	800-1600	B	EL	..	S	60½	32	49	1870
6R	M-S	4	6	3½ x 5½	27-54	800-1600	B	EL	..	S or T	76½	32	49	2460
4P	M-S	4	4	3¾ x 5½	20-40	800-1600	B	EL	..	S	60½	32	49	1870
6P	M-S	4	6	3¾ x 5½	29-64	800-1800	B	EL	..	S	71¼	32	49	2480
6K	M-S	4	6	4¼ x 5½	38-78	800-1600	B	EL	..	S	74	32	51	2650

Engines have pre-combustion system. Dimensions and weights given are for marine models.

Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
T	M-S-P	4	6	7 x 8½	200	1000	O	A-EL	..	RR	86	48	69	9300
TS	M-S-P	4	6	7 x 8½	285	1000	O	A-EL	M	RR	86	48	69	9500
TS	M-S-P	4	8	7 x 8½	380	1000	O	A-EL	M	RR	108	48	69	12200
S	M-S-P	4	6	10½ x 12	450	720	O	A-EL	..	RR	132	40	85	21500
S	M-S-P	4	7	10½ x 12	525	720	O	A-EL	..	RR	149	40	85	24300
S	M-S-P	4	8	10½ x 12	600	720	O	A-EL	..	RR	165	40	85	27800
SS	M-S-P	4	6	10½ x 12	710	720	O	A-EL	TC	RR	132	40	85	23600
SS	M-S-P	4	7	10½ x 12	825	720	O	A-EL	TC	RR	149	40	85	27000
SS	M-S-P	4	8	10½ x 12	945	720	O	A-EL	TC	RR	165	40	85	30600

Engines have open type combustion chambers. RR—Reverse and reduction gear, make not given.

International Harvester Company
180 North Michigan Avenue
Chicago, Illinois

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
UD-6A	S-P	4	4	3¾ x 5¼	45	1600	O	G-EL	..	..	62⅝	26⅝	50¼	1765
UD-9A	S-P	4	4	4.4 x 5.5	62.5	1600	O	G-EL	..	..	67¾	28½	52	2060
UD-14A	S-P	4	4	4¾ x 6½	76	1400	O	G-EL	..	..	78	33⅛	56½	2650
UD-16	S-P	4	6	4.4 x 5.5	100	1800	O	G-EL	..	..	88⅛	33⅛	55⅝	3095
UD-18A	S-P	4	6	4¾ x 6½	125	1600	O	G-EL	..	..	95⅞	35⅞	59¾	4000
UD-24	S-P	4	6	5¾ x 7	180	1375	O	G-EL	..	..	107⅛	44	64	5800

Horsepower shown is net for complete power unit with radiator and fan as obtained at sea level with regular production injection pump setting. Dimensions include radiator and direct drive rear power take-off.

Kahlenberg Brothers Company
Two Rivers, Wisconsin

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weigh Lb.
AD	M	2	2	....	30- 36	375-400	O	A	..	†	..	..	..	4450
AT	M	2	3	....	45- 54	375-400	O	A	..	*	..	..	..	6500
BD	M	2	2	....	50- 60	340-375	O	A	..	†	..	..	..	7300
AF	M	2	4	....	70	375-400	O	A	..	*	..	..	..	8200
BT	M	2	3	....	90	340-375	O	A	..	*	..	..	..	9700
BF	M	2	4	....	120	340-375	O	A	..	*	..	..	..	11980
B5	M	2	5	....	150	340-375	O	A	..	*	..	..	..	15650
CT	M	2	3	....	150	275-325	O	A	..	*	..	..	..	21730
B6	M	2	6	....	180	340-375	O	A	..	*	..	..	..	17050
CF	M	2	4	....	200	275-325	O	A	..	*	..	..	..	23900
C5	M	2	5	....	250	275-325	O	A	..	D	..	..	..	29000
C6	M	2	6	....	300	275-325	O	A	..	D	..	..	..	34000

*All engines have pre-combustion chambers. † Reverse gear used. * Direct reverse. Reverse gear optional.*

Kermath Manufacturing Company
5890 Commonwealth Avenue
Detroit, Michigan

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weigh Lb.
2-127	M	4	2	4¼ x 4½	27	1800	B	EL&H	..	S	37[illegible]	25⅞	30⅛	900
4-226	M	4	4	4 x 4½	60	2600	B	EL	..	S	47⅞[illegible]	24	33	1250
6-298	M	4	6	3¾ x 4½	75	2000	B	EL	..	S	54¾[illegible]	25⅛	33	1550
6-529	M	4	6	4⅝ x 5¼	130	1800	B	EL	..	S	62⅜	27⅝	37⅛	2450
6-935	M	4	6	5¾ x 6	250	2000	B	EL	..	C	88⅛	36⅛	50¼	5000

All engines have turbulence chamber type combustion system.

The Lathrop Engine Co.
Mystic, Conn.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb
D50	M	4	4	5½ x 7	50	800	B	EL	..	O	75	29	31	3000
D60	M	4	4	5½ x 7	60	900	B	EL	..	O	75	29	31	3000
D80	M	4	6	5½ x 7	80	800	B	EL	..	S	96¼	30½	31	4200
D90	M	4	6	5½ x 7	90	900	B	EL	..	S	96¼	30½	31	4200
D100	M	4	6	5½ x 7	100	1000	B	EL	..	S	92½	30½	31	4000
DH-200	M	4	6	5¾ x 6	187	1600	B	EL	..	C	96	38¾	43¼	5100

Mack Manufacturing Corporation
5th Avenue & 34th Street
New York, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb
END510*	P	4	6	4⅞ x 5½	138	2400	B	EL	..	..	49½	32½	45⅝	1991
END672*	P	4	6	4⅞ x 6	165	2000	B	EL	..	..	55¹⁰⁄₁₆	31⅝	46⅞	2243
END672†	P	4	6	4⅞ x 6	165	2000	B	EL	..	..	49⅞	33	44½	2471

** Truck engine. † Bus engine. All models have energy cell combustion systems.*

Mechanical Equipment Company
861 Carondelet Corner St. Joseph Sts.
New Orleans 13, Louisiana

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
B6	M	4	6	3¾ x 4	79	2600	B	EL	..	S	51¹⁵⁄₁₆	22	16¾	1050
D6	M	4	6	5¼ x 6	175	1900	B	EL-G-A	..	S	71⅛	24¼	29⅞	2950
E6	M	4	6	6¼ x 6½	202	1600	B	EL-G-A	..	S	94	26	37⅛	5100
G6	M	4	6	8½ x 8½	340	1050	B	EL-G-A	..	S	144⁷⁄₁₆	32½	49¾	11950

Pre-combustion chambers are used on all engines. Horsepower ratings are maximum. Height above shaft is given.

Murphy Diesel Company
5317 West Burnham Street
Milwaukee, Wisconsin

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ME4	P	4	4	5¾ x 6½	90	1200	O	EL	..	..	70	42⅛	65⅛	3800
11	P	4	4	5¾ x 6½	100–110	1200–1400	O	EL	..	..	70	42⅛	65⅛	3800
12	P	4	4	6 x 6½	110–120	1200–1400	O	EL	..	..	70	42⅛	65⅛	3800
111	P	4	4	5¾ x 6½	115–125	1200–1400	O	EL	**	..	70	42⅛	65⅛	3900
112	P	4	4	6 x 6½	125–135	1200–1400	O	EL	**	..	70	42⅛	65⅛	3900
20*	P	4	6	5½ x 6½	135–145	1200–1400	O	EL	..	..	92½	42⅛	65⅛	4700
120	P	4	6	5½ x 6½	145–157	1200–1400	O	EL	**	..	92½	42⅛	65⅛	4800
21*	P	4	6	5¾ x 6½	150–162	1200–1400	O	EL	..	..	92½	42⅛	65⅛	4700
22*	P	4	6	6 x 6½	165–178	1200–1400	O	EL	..	..	92½	42⅛	65⅛	4700
121	P	4	6	5¾ x 6½	170–184	1200–1400	O	EL	**	..	92½	42⅛	65⅛	4800
122	P	4	6	6 x 6½	190–205	1200–1400	O	EL	**	..	92½	42⅛	65⅛	4800
ME90	M	4	4	5¾ x 6½	90	1200	O	EL	..	T	91	29	63	6500
M100	M	4	4	5¾ x 6½	100	1200	O	EL	..	T	91	39	63	6650
M110	M	4	4	6 x 6½	110	1200	O	EL	..	T	91	39	63	6685
M115	M	4	4	5¾ x 6½	115	1200	O	EL	..	T	91	39	63	6830
M125	M	4	4	6 x 6½	125	1200	O	EL	..	T	91	39	63	6860
M135	M	4	6	5½ x 6½	135–145	1200–1400	O	EL	..	S-T	115	38	61	7940
M145	M	4	6	5½ x 6½	145–157	1200–1400	O	EL	**	S-T	115	38	55	8255
M150	M	4	6	5¾ 6½	150–162	1200–1400	O	EL	..	S-T	115	38	61	8000
M165	M	4	6	6 x 6½	165–178	1200–1400	O	EL	..	T	115	38	61	8000
M170	M	4	6	5¾ x 6½	170–184	1200–1400	O	EL	**	T	115	38	55	8265
M190	M	4	6	6 x 6½	190–205	1200–1400	O	EL	**	T	115	38	55	8265

*All engines have open type combustion chambers and unit injectors. * Stationary models available as dual-fuel and crude oil engine. **Tuho supercharging manifold. Higher of dual ratings is accompanied with change in model number. For portable engines, "2" is prefixed in the case of two letter numbers and added to the first in the case of three (111 become: 311, etc.). For marine engines "A" follows the "M" and in turn is followed by the higher horsepower (M135 becomes MA145, etc.)*

The National Supply Company
Engine Division, Mfgrs. of Superior and Atlas Engines
1401 Sheridan Ave., Springfield 99, Ohio

Superior Engines

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
40-6	S-M	4	6	8½ x 10½	215–325	600–900	..	..	..	..	..	..	..	.....
40-8	S-M	4	8	8½ x 10½	290–435	600–900	..	..	..	..	..	..	..	.....
40-X-6	S-M	4	6	8½ x 10½	325–490	600–900	..	..	TC	..	..	..	..	.....
40-X-8	S-M	4	8	8½ x 10½	435–650	600–900	..	..	TC	..	..	..	..	.....
60-6	S-M	4	6	12 x 15	410–530	400–514	..	..	..	..	..	..	..	.....
60-8	S-M	4	8	12 x 15	550–615	400–450	..	..	..	..	..	..	..	.....
60-X-6	S-M	4	6	12 x 15	615–795	400–514	..	..	TC	..	..	..	..	.....
60-X-8	S-M	4	8	12 x 15	825–925	400–450	..	..	TC	..	..	..	..	.....
65-6	S-M	4	6	12¾ x 15	580–700	500–600	..	..	..	..	..	..	..	.....
65-8	S-M	4	8	12¾ x 15	775–930	500–600	..	..	..	..	..	..	..	.....
65-X-6	S-M	4	6	12¾ x 15	940–1125	500–600	..	..	TC	..	..	..	..	.....
65-X-8	S-M	4	8	12¾ x 15	1255–1500	500–600	..	..	TC	..	..	..	..	.....
80-6	S-M	4	6	14½ x 20	600–720	300–360	..	..	..	..	..	..	..	.....
80-8	S-M	4	8	14½ x 20	800–960	300–360	..	..	..	..	..	..	..	.....
80-X-6	S-M	4	6	14½ x 20	900–1080	300–360	..	..	TC	..	..	..	..	.....
80-X-8	S-M	4	8	14½ x 20	1200–1440	300–360	..	..	TC	..	..	..	..	.....

Atlas Engines

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
35-4	S	4	4	6½ x 8¼	100–130	900–1200	..	..	..	..	..	..	..	.....
35-6	S	4	6	6½ x 8¼	150–190	900–1200	..	..	..	..	..	..	..	.....
35-X-6	S	4	6	6½ x 8¼	225–300	900–1200	..	..	TC	..	..	..	..	.....
45-4	S	4	4	9 x 10½	160–190	600–720	..	..	..	..	..	..	..	.....
45-5	S	4	5	9 x 10½	200–240	600–720	..	..	..	..	..	..	..	.....
45-6	S	4	6	9 x 10½	240–300	600–750	..	..	..	..	..	..	..	.....
45-8	S	4	8	9 x 10½	320–400	600–750	..	..	..	..	..	..	..	.....
45-X-6	S	4	6	9 x 10½	360–450	600–756	..	..	TC	..	..	..	..	.....
45-X-8	S	4	8	9 x 10½	480–600	600–750	..	..	TC	..	..	..	..	.....
58-6	S	4	6	11½ x 15	320–350	327–360	..	..	..	..	..	..	..	.....
75-6	S	4	6	13 x 16	425	327–333	..	..	..	..	..	..	..	.....
75-X-6	S	4	6	13 x 16	600	327–333	..	..	TC	..	..	..	..	.....

(Atlas engine specifications continued on next page)

The National Supply Co.

(Continued from the preceding page)

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
76-6	S	4	6	13 x 16	460–500	360–400								
76-X-6	S	4	6	13 x 16	675–750	360–400			TC					
85-6	S	4	6	15 x 19	650	327–333								
85-X-6	S	4	6	15 x 19	1000	327–333			TC					
35-4	M	4	4	6½ x 8¼	100	900								
35-6	M	4	6	6½ x 8¼	150–190	900–1200								
35-X-6	M	4	6	6½ x 8¼	225–300	900–1200			TC					
38-4	M	4	4	8 x 10½	85*	450								
45-4	M	4	4	9 x 10½	160	600								
45-5	M	4	5	9 x 10½	200	600								
45-6	M	4	6	9 x 10½	240–300	600–750								
45-8	M	4	8	9 x 10½	320–400	600–750								
45-X-6	M	4	6	9 x 10½	360–450	600–750			TC					
45-X-8	M	4	8	9 x 10½	480–600	600–750			TC					
48-4	M	4	4	9 x 12	110*	325								
55-6	M	4	6	10½ x 13	250	350								
58-6	M	4	6	11½ x 15	320–350	325–360								
75-6	M	4	6	13 x 16	425	325								
75-X-6	M	4	6	13 x 16	600	325			TC					
85-6	M	4	6	15 x 19	650	325								
85-X-6	M	4	8	15 x 19	1000	325			TC					

** With reduction gear or reverse gear, the friction loss in gear must be deducted from the engine rating to obtain net horsepower delivered to propeller shaft. Exceptions are Models 38-4 and 48-4, for which the net horsepower delivered to propeller shaft is shown.*

Nordberg Manufacturing Company
Milwaukee, Wisconsin

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
4FS-1	S	4	1	4½ x 5¼	10–15	1200–1800		EL-H						
4FS-2	S	4	2	4½ x 5¼	20–30	1200–1800		EL-H						
4FS-3	S	4	3	4½ x 5¼	30–45	1200–1800		EL-H						
PS-95	S	4	5	9 x 11½	220–265	600–720		A						
PS-96	S	4	6	9 x 11½	265–445	600–1000		A						
PS-97	S	4	7	9 x 11½	310–515	600–1000		A						
PS-98	S	4	8	9 x 11½	355–590	600–1000		A						
PS-95-SC	S	4	5	9 x 11½	330–400	600–720		A	TC					
PS-96-SC	S	4	6	9 x 11½	400–665	600–1000		A	TC					
PS-97-SC	S	4	7	9 x 11½	465–770	600–1000		A	TC					
PS-98-SC	S	4	8	9 x 11½	530–885	600–1000		A	TC					
PS-96-SC*	S	4	6	9 x 11½	535–890	600–1000		A	TC					
PS-97-SC*	S	4	7	9 x 11½	620–1035	600–1000		A	TC					
PS-98-SC*	S	4	8	9 x 11½	710–1180	600–1000		A	TC					
PS-135	S	4	5	13 x 16½	500–570	450–514		A						
PS-136	S	4	6	13 x 16½	600–800	450–600		A						
PS-137	S	4	7	13 x 16½	700–935	450–600		A						
PS-138	S	4	8	13 x 16½	800–1065	450–600		A						
PS-135-SC	S	4	5	13 x 16½	750–850	450–514		A	TC					
PS-136-SC	S	4	6	13 x 16½	900–1200	450–600		A	TC					
PS-137-SC	S	4	7	13 x 16½	1050–1400	450–600		A	TC					
PS-138-SC	S	4	8	13 x 16½	1200–1600	450–600		A	TC					
PS-1310-SC	S	4	10	13 x 16½	1500–2000	450–600		A	TC					
PS-1312-SC	S	4	12	13 x 16½	1803–2400	450–600		A	TC					
PS-1314-SC	S	4	14	13 x 16½	2100–2800	450–600		A	TC					
PS-1316-SC	S	4	16	13 x 16½	2400–3200	450–600		A	TC					
PS-136-SC*	S	4	6	13 x 16½	1200–1600	450–600		A	TC					
PS-137-SC*	S	4	7	13 x 16½	1400–1865	450–600		A	TC					
PS-138-SC*	S	4	8	13 x 16½	1600–2135	450–600		A	TC					
PS-1310-SC*	S	4	10	13 x 16½	2000–2670	450–600		A	TC					
PS-1312-SC*	S	4	12	13 x 16½	2400–3200	450–600		A	TC					
PS-1314-SC*	S	4	14	13 x 16½	2800–3730	450–600		A	TC					
PS-1316-SC*	S	4	16	13 x 16½	3200–4270	450–600		A	TC					
PS-165	S	4	5	16 x 22	730	327		A						
PS-166	S	4	6	16 x 22	875	327		A						
PS-167	S	4	7	16 x 22	1020	327		A						
PS-168	S	4	8	16 x 22	1165	327		A						
PS-165-SC	S	4	5	16 x 22	1090	327		A	TC					
PS-166-SC	S	4	6	16 x 22	1310	327		A	TC					
PS-167-SC	S	4	7	16 x 22	1530	327		A	TC					
PS-168-SC	S	4	8	16 x 22	1750	327		A	TC					
PS-166-SC*	S	4	6	16 x 22	1750	327		A	TC					
PS-167-SC*	S	4	7	16 x 22	2040	327		A	TC					
PS-168-SC*	S	4	8	16 x 22	2340	327		A	TC					
5DB-24½	S	4	5	16½ x 24½	735–795	277–300		A						
6DB-24½	S	4	6	16½ x 24½	880–955	277–300		A						
7DB-24½	S	4	7	16½ x 24½	1030–1115	277–300		A						
8DB-24½	S	4	8	16½ x 24½	1175–1270	277–300		A						
5DBT-24½	S	4	5	16½ x 24½	1100–1190	277–300		A	TC					
6DBT-24½	S	4	6	16½ x 24½	1320–1430	277–300		A	TC					
7DBT-24½	S	4	7	16½ x 24½	1540–1670	277–300		A	TC					
8DBT-24½	S	4	8	16½ x 24½	1760–1900	277–300		A	TC					
RTS-1411	S	2	11	14 x 16	1950	400		A						
RTS-1412	S	2	12	14 x 16	2125	400		A						
TS-175	S	2	5	17½ x 25	1570–1700	277–300		A						
TS-176	S	2	6	17½ x 25	1890–2040	277–300		A						
TS-177	S	2	7	17½ x 25	2200–2380	277–300		A						
TS-178	S	2	8	17½ x 25	2520–2720	277–300		A						
TS-179	S	2	9	17½ x 25	2830–3060	277–300		A						
TS-215-31	S	2	5	21½ x 31	2400–2550	225–240		A						
TS-216-31	S	2	6	21½ x 31	2900–3100	225–240		A						
TS-217-31	S	2	7	21½ x 31	3350–3600	225–240		A						
TS-218-31	S	2	8	21½ x 31	3850–4100	225–240		A						
TS-219-31	S	2	9	21½ x 31	4300–4600	225–240		A						
TS-2110-31	S	2	10	21½ x 31	4800–5100	225–240		A						
TS-2111-31	S	2	11	21½ x 31	5300–5600	225–240		A						
TS-2112-31	S	2	12	21½ x 31	5750–6100	225–240		A						
TS-295	S	2	5	29 x 40	4300–4500	171–180		A						
TS-296	S	2	6	29 x 40	5100–5400	171–180		A						
TS-297	S	2	7	29 x 40	6000–6300	171–180		A						
TS-298	S	2	8	29 x 40	6800–7200	171–180		A						
TS-299	S	2	9	29 x 40	7700–8100	171–180		A						
TS-2910	S	2	10	29 x 40	8500–9000	171–180		A						
TS-2911	S	2	11	29 x 40	9400–9900	171–180		A						
TS-2912	S	2	12	29 x 40	10200–10800	171–180		A						

These engines are designed to operate continuously at the ratings shown and are good for 10 per cent overload for 2 hours in any 24 hour period.
** Supairthermal Execution.*

Osco Motors Corporation
3627 W. Lawrence Street
Philadelphia, Pennsylvania

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
235D	M-S	4	2	4 x 4½	28	1800	B	EL	..	P	38	27⅛	36⅛	850†-1027*
235X	M-S	4	2	4 x 4½	28	1800	B	EL	..	P	45⅛	27⅛	36⅛	910†-1075*
235Z	M-S	4	2	4 x 4½	28	1800	B	EL	..	P	45⅛	27⅛	36⅛	925†-1088*
470D	M-S	4	4	4 x 4½	70	2600	B	EL	..	P	45⅛	22	35½	1200†-1385*
470TD-2	M-S	4	4	4 x 4½	70	2600	B	EL	..	T	49⅛	22	35½	1260†-1417*
470TD-3	M-S	4	4	4 x 4½	70	2600	B	EL	..	T	49⅛	22	35½	1275†-1430*
685D	M-S	4	6	3¾ x 4½	85	2600	B	EL	..	P	52⅛	22	37⅛	1365†-1423*
685TD-2	M-S	4	6	3¾ x 4½	85	2600	B	EL	..	T	60½	22	37⅛	1430†-1513*
685TD-3	M-S	4	6	3¾ x 4½	85	2600	B	EL	..	T	60½	22	37⅛	1450†-1526*

** Marine weight. † Stationary weight.*

Page Engineering Company
Clearing Post Office
Chicago 38, Illinois

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
9½ x 12½	P	4	3	9½ x 12½	135	500	BS	A	..	..	72	84	42	12750
11 x 15	P	4	3	11 x 15	195	450	BS	A	..	..	82	99	51	16750
11 x 15	P	4	4	11 x 15	260	450	BS	A	..	..	104½	99	51	22330
11 x 15	P	4	5	11 x 15	325	450	BS	A	..	..	122	99	51	27750
12½ x 16	P	4	3	12½ x 16	270	450	BS	A	..	..	90½	110½	55	21750
12½ x 16	P	4	4	12½ x 16	360	450	BS	A	..	..	114	110½	55	29330
12½ x 16	P	4	5	12½ x 16	450	450	BS	A	..	..	132½	110½	55	36200
12½ x 16	P	4	6	12½ x 16	540	450	BS	A	..	..	156	110½	55	43500

All engines are of the horizontal type and are designed especially for dragline excavator service.

Palmer Brothers Engine Corporation
Cos Cob, Connecticut

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RND-1	S	4	1	4½ x 6	9	1000	B	H	..	..	31½	25	41	900
RND-4	M-S	4	4	4½ x 6	40	1200	B	EL-H	..	O	72	26¾	42	2500
RND-6	M-S	4	6	4½ x 6	60	1200	B	EL-H	..	O	88½	24½	45	3200
RND-4G2	M-S	4	4	4½ x 6	40	1200	B	EL-H	..	O	80	26¾	42	2590
RND-6G2	M-S	4	6	4½ x 6	60	1200	B	EL-H	..	O	95½	24½	45	3300
PM-672	M-S	4	6	4⅞ x 6	120	1600	B	EL	..	T	79¼	26	29¾	3400

RND models have Russell-Newbury turbulence chamber. Height is given above shaft centerline.

Rathbun-Jones Engineering Company
Toledo, Ohio

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
18	S	4	3	11 x 18	220	450	O	A	..	..	158	70	106	26000
18	S	4	4	11 x 18	290	450	O	A	..	..	177	70	106	31500
18	S	4	5	11 x 18	364	450	O	A	..	..	196	70	106	36300
18	M-S	4	6	11 x 18	435	450	O	A	..	D	215	70	106	37600*-41200†
18	M-S	4	7	11 x 18	510	450	O	A	..	D	238	70	106	41900*-46000†
18	M-S	4	8	11 x 18	580	450	O	A	..	D	258	70	106	46500*-51000†
22	S	4	3	15½ x 22	388	327	O	A	..	..	175	80	126	41500
22	S	4	4	15½ x 22	518	327	O	A	..	..	197	80	126	50000
22	S	4	5	15½ x 22	650	327	O	A	..	..	225	80	126	58500
22	M-S	4	6	15½ x 22	775	327	O	A	..	D	247	80	126	64000*-68000†
22	M-S	4	7	15½ x 22	910	327	O	A	..	D	271	80	126	71000*-75500†
22	M-S	4	8	15½ x 22	1035	327	O	A	..	D	293	80	126	82000*-85000†
24	S	4	3	18¾ x 24	540	300	O	A	..	..	200	85	140	60000
24	S	4	4	18¾ x 24	720	300	O	A	..	..	231	85	140	74000
24	S	4	5	18¾ x 24	900	300	O	A	..	..	258	85	140	87000
24	M-S	4	6	18¾ x 24	1080	300	O	A	..	D	294	85	140	90000*-98000†
24	M-S	4	7	18¾ x 24	1260	300	O	A	..	D	321	85	140	103000*-110000†
24	M-S	4	8	18¾ x 24	1440	300	O	A	..	D	348	85	140	116000*-120000†
28	S	4	5	19½ x 28	1025	257	O	A	..	..	332	104	171	140000
28	M-S	4	6	19½ x 28	1230	257	O	A	..	D	339	104	171	160000*-164000†
28	M-S	4	7	19½ x 28	1435	257	O	A	..	D	380	104	171	184000*-187000†
28	M-S	4	8	19½ x 28	1640	257	O	A	..	D	409	104	171	209000*-212000†
28	S	4	10	19½ x 28	2050	257	O	A	..	..	460	104	171	230000
28	S	4	12	19½ x 28	2460	257	O	A	..	..	528	104	171	260000

*Engines have Price turbulence chamber combustion system and Rathbun distributor type fuel injection system. Lengths listed are approximate for stationary engines and include generator, excitor drive and outboard bearing. Widths include operating platforms. Marine lengths including thrust bearing are considerably shorter. All engines can be furnished for dual-fuel operation. * Marine weight. † Stationary weight.*

Red Wing Motor Company
Red Wing, Minnesota

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
H4-54	M	4	4	4 x 5	42- 54	1500	B	EL	..	P	49	17½	32	1000
H4-60	M	4	4	5⅛ x 5¼	55- 60	1400	B	EL	..	P	53	17½	34	1200
H6-140	M	4	6	4½ x 5½	100- 140	1500	B	EL	..	S	72	24½	40	2000
D4-30	M	4	4	3¼ x 3¾	30	1800	B	EL	..	S	43	24½	29½	825
D-65	M	4	4	4¼ x 4½	65	1900	B	EL	..	P	57	23½	35	1400
D6-160	M	4	6	5¼ x 6	160	1400	B	EL	..	S	75	27	34	3000
D6-200	M	4	6	6¼ x 6½	200	1300	B	EL	..	S	86	36	36	5000

"H" models are Waukesha-Hesselman units adapted for marine use. "D" model is full compression ignition diesel engine.

R. H. Sheppard Company, Incorporated
Hanover, Pennsylvania

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
14*	S	4	1	3 x 4	3¾	1800	O	H-EL	..	..	22½	20¾	28½	415
14C*	M	4	1	3 x 4	3¾	1800	O	H-EL	..	P	37	21⅜	29⅝	490
8	S	4	1	3 x 4	3¾	1800	O	H-EL	..	..	22½	20⅝	28½	420
7	S	4	1	4 x 5	10	1800	O	H-EL	..	..	37	30⅝	49½	1090
7D	S	4	1	4¼ x 5	11	1800	O	H-EL	..	..	37	30⅝	49½	1090
7C	M	4	1	4 x 5	8	1200	O	H-EL	..	S	37⅛	23½	41¾	1100
7F	M	4	1	4¼ x 5	9	1200	O	H-EL	..	..	37⅛	23½	41¾	1100
13	S	4	2	4 x 5	18	1400	O	H-EL	..	..	42⅝	19¼	45	1365
13D	S	4	2	4¼ x 5	22	1800	O	H-EL	..	..	42⅝	19¼	45	1365
13C	M	4	2	4 x 5	20	1800	O	H-EL	..	S	44	23½	37¾	1500
13F	M	4	2	4¼ x 5	22	1800	O	H-EL	..	S	44	23½	37¾	1500
6	S	4	3	4 x 5	28	1400	O	H-EL	..	..	53⅞	25	46½	1662
6D	S	4	3	4¼ x 5	34	1800	O	H-EL	..	..	53⅞	25	46½	1662
6C	M	4	3	4 x 5	30	1800	O	H-EL	..	S	51⅞	23½	37¾	1865
6F	M	4	3	4¼ x 5	34	1800	O	H-EL	..	S	51⅞	23½	37¾	1865
12	S	4	6	4 x 5	61	1800	O	EL	..	..	69½	24	49¾	2100
12D	S	4	6	4¼ x 5	67	1800	O	EL	..	..	69½	24	49¾	2100
12C	M	4	6	4 x 5	61	1800	O	EL	..	S	71	24½	40¾	2250
12F	M	4	6	4¼ x 5	67	1800	O	EL	..	S	71	24½	40¾	2250

*All engines have pre-combustion type chambers. * Air cooled.*

Sterling Engine Company
Buffalo, New York

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb
1AB-6	S	4	6	4½ x 5¾	72– 110	1400–1800	B	EL	..	..	57⅝	30	52⅜	3150
MAB-6	M	4	6	4½ x 5¾	72– 110	1400–1800	B	EL	..	S	66⅛	33¼	38⅞	2650
MRAB-6	M	4	6	4½ x 5¾	72– 110	1400–1800	B	EL	..	S	75⅛	33¼	38⅞	2800
1DB-6	S	4	6	5½ x 7	114– 170	1200–1500	B	EL	..	..	59⅛	36	59⅛	5200
MDB-6	M	4	6	5½ x 7	114– 170	1200–1500	B	EL	..	S	87⅛	39⅛	49⅝	4700
MRDB-6	M	4	6	5½ x 7	114– 170	1200–1500	B	EL	..	S	97⅛	39⅛	49⅝	5000
1DB-8	S	4	8	5½ x 7	152– 230	1200–1500	B	EL	..	..	74⅛	36	59⅛	6850
MDB-8	M	4	8	5½ x 7	152– 230	1200–1500	B	EL	..	S	103⅛	39⅛	49⅝	5850
MRDB-8	M	4	8	5½ x 7	152– 230	1200–1500	B	EL	..	S	120⅛	39⅛	49⅝	6400
VDS-6	S	4	6	8 x 9	325– 470	1200–1500	BS	EL-A	..	..	95	39¼	63¼	8500
VDM-6	M	4	6	8 x 9	325– 470	1200–1500	BS	EL-A	..	S-T	136⅝*	40½	67½	12000
VDS-6-S	S	4	6	8 x 9	660– 940	1200–1500	B	EL-A	TC	..	114¼	39¼	63⅛	9160
VDM-6-S	M	4	6	8 x 9	660– 940	1200–1500	B	EL-A	TC	S	141	40½	70¼	13600
VDS-8-S	S	4	8	8 x 9	880–1250	1200–1500	B	EL-A	TC	..	134⅝	39¼	64	12450

*All engines have open type combustion chambers. Dual listings indicate continuous and intermittent ratings. *Snow-Nabstedt; for Twin Disc—add 9⅛ in.*

Sun Shipbuilding and Dry Dock Co.
Chester, Pennsylvania

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
510-LB-3	M	2	3	20 1/16 x 44 1/8 +33 1/16	1500	90	O	A	..	D	444	132	336	322000
540-L-4	M	2	4	21¼ x 42½ +42½	2500	90	O	A	..	D	576	132	361⅞*	470000
580-L-4	M	2	4	22 1/16 x 45 5/8 +45 5/8	2800	80	O	A	..	D	612	134	389	580000
600-L-4	M	2	4	23 5/8 x 45 5/8 +45 5/8	3000	80	O	A	..	D	624	134	389	625000
600-LB-4	M	2	4	23 5/8 x 45 5/8 +33 7/16	2700	100	O	A	..	D	624	134	384¼*	600000
640-LB-6	M	2	6	25 5/16 x 45 5/8 +33 7/16	5600	100	O	A	..	D	816	134	426½*	930000
26-LB-4	M	2	4	26 x 46 +33	3600	115	O	A	..	D	623¾	134	400⅝*	655000
31-LB-4	M	2	4	31 x 50 +36	4800	90	O	A	..	D	729	152	432⅞*	1015000
31-LB-5	M	2	5	31 x 50 +36	7200	100	O	A	..	D	807¾	152	406½	1166000
32-LB-4	M	2	4	32 x 55 +40	6000	94	O	A	..	D	735⅝	152	427	1052000
32-LB-5	M	2	5	32 x 55 +40	7500	94	O	A	..	D	861 11/16	152	489¼*	1342000
21-LB-6†	M	2	6	21 x 35 +25	4500	180	O	A	..	D	601⅞	126¼	292	450000
...	S	2	4	21 x 35 +25	3000	200	..	..	..	..	539¼	126¼	315*	366000
...	S	2	5	21 x 35 +25	3800	200	..	..	..	..	628½	126¼	325*	458000
...	S	2	6	21 x 35 +25	4500	200	..	..	..	..	718	126¼	333*	550000
...	S	2	4	26 x 46 +33	4500	150	..	..	..	..	623¾	134	400⅝*	655000
...	S	2	5	26 x 46 +33	6000	150	..	..	..	..	756¾	134	399*	820000
...	S	2	6	26 x 46 +33	7500	150	..	..	..	..	862½	134	411*	985000
...	S	2	4	32 x 55 +40	9000	138	..	..	..	..	735¾	152	467¼*	1145000
...	S	2	5	32 x 55 +40	11200	138	..	..	..	..	861¾	152	489¼*	1342000
...	S	2	6	32 x 55 +40	13500	138	..	..	..	..	1092	152	443¼*	1700000

*Engines are of the opposed-piston type. † Drives through reduction gear (Ratio 2.092 to 1) Maximum heights shown. * Height to top of scavenging air pump. Other figures show cylinder height.*

Union Diesel Engine Co.
Oakland, Calif.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
GA6	S-M	4	6	8½ x 11	175– 225	450– 600	O	A	..	D	144	34	72	14000
GA6S	S-M	4	6	8½ x 11	260– 330	450– 600	O	A	TC	D	146	34	72	15000
L6	S-M	4	6	10 x 14	230– 340	350– 514	O	A	..	D	175	42	85	23500
L6S	S-M	4	6	10 x 14	340– 500	350– 514	O	A	TC	D	178	42	85	24500
P6	S-M	4	6	12 x 15	410– 525	400– 514	O	A	..	D	194	46	93	36500
P6S	S-M	4	6	12 x 15	600– 775	400– 514	O	A	TC	D	194	46	93	38000
V6	S-M	4	6	14 x 19	560– 690	325– 400	O	A	..	D	242	57	114	58000
V6S	S-M	4	6	14 x 19	740–1020	325– 400	O	A	TC	D	242	57	114	60000
Z6	S-M	4	6	16 x 20½	600– 750	240– 300	O	A	..	D	275	62	125	87500
Z6S	S-M	4	6	16 x 20½	900–1125	240– 300	O	A	TC	D	285	62	125	90000
GA8	S-M	4	8	8½ x 11	235– 300	450– 600	O	A	..	D	178	34	72	18000
GA8S	S-M	4	8	8½ x 11	345– 440	450– 600	O	A	TC	D	180	34	72	19000
L8	S-M	4	8	10 x 14	300– 450	350– 514	O	A	..	D	214	42	85	32000
L8S	S-M	4	8	10 x 14	420– 660	350– 514	O	A	TC	D	217	42	85	33500
P8	S-M	4	8	12 x 15	550– 700	400– 514	O	A	..	D	235	46	93	46000
P8S	S-M	4	8	12 x 15	800–1040	400– 514	O	A	TC	D	239	46	93	48000
V8	S-M	4	8	14 x 19	750– 925	325– 400	O	A	..	D	292	57	114	74000
V8S	S-M	4	8	14 x 19	1125–1400	325– 400	O	A	TC	D	296	57	114	76000
Z8	S-M	4	8	16 x 20½	800–1000	240– 300	O	A	..	D	347	62	125	112000
Z8S	S-M	4	8	16 x 20½	1200–1500	240– 300	O	A	TC	D	350	62	125	115000

All engines are 4-cycle, single-acting, vertical and use the exclusive, solid injection type UNION fuel system. Starting is by air at approximately 250 p.s.i pressure. Supercharging is by Buchi turbocharger system.

United States Motors Corporation
Oshkosh, Wisconsin

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Heigth In.	Weight Lb.
2FMB12	M-S	4	1	3 1/16 x 4	3.75	1200	O	H-EL	..	..	37	22	31	675
3FMB18	M-S	4	1	3 1/16 x 4	5.25	1800	O	H-EL	..	..	37	22	31	675
5DAC12	M-S	4	4	3 1/16 x 3 3/4	20	1200	B	EL	..	..	55	26	43	1500
5DAC14	M	4	4	3 1/16 x 3 3/4	22	1400	B	EL	..	..	55	26	43	1500
5DAC18	S	4	4	3 1/16 x 3 3/4	30	1800	B	EL	..	..	55	26	43	1500
705DAC12	M-S	4	4	3 1/16 x 3 3/4	20	1200	B	EL	..	..	59	26	43	1550
704D4D12	M-S	4	4	3 3/4 x 4	26	1200	B	EL	..	..	62	23	43	1600
705DAC14	M	4	4	3 1/16 x 3 3/4	22	1400	B	EL	..	..	59	26	43	1550
705DAC18	M-S	4	4	3 1/16 x 3 3/4	30	1800	B	EL	..	..	59	26	43	1550
10DAC12	M-S	4	4	3 1/16 x 3 3/4	20	1200	B	EL	..	..	60	26	43	1650
10D4D12	M-S	4	4	3 3/4 x 4	26	1200	B	EL	..	..	65	26	43	1700
10DAC14	M	4	4	3 1/16 x 3 3/4	22	1400	B	EL	..	..	60	26	43	....
10DAC18	M-S	4	4	3 1/16 x 3 3/4	30	1800	B	EL	..	..	60	26	43	....
10D4D18	M-S	4	4	3 3/4 x 4	41.5	1800	B	EL	..	..	65	25	43	1700
15DC12	M-S	4	4	4 x 4 1/2	42	1200	B	EL	..	..	70	25	47	....
15DAC18	M-S	4	4	3 1/16 x 3 3/4	30	1800	B	EL	..	..	60	26	43	....
15D4D18	M-S	4	4	3 3/4 x 4	46.5	1800	B	EL	..	..	67	25	43	1800
20DJC12	M-S	4	6	3 3/4 x 4 1/2	47	1200	B	EL	..	..	76	25	43	2400
20D4D18	M-S	4	4	3 3/4 x 4	41.5	1800	B	EL	..	..	69	25	43	2000
25DJH12	M-S	4	6	3 3/4 x 4 1/2	52	1200	B	EL	..	..	88	28	48	2900
25DC18	S	4	4	4 x 4 1/2	55.8	1800	B	EL	..	..	70	25	47	2500
30DWD12	M-S	4	6	4 1/4 x 4 3/4	70	1200	B	EL	..	..	93	31	52	3700
30DJC18	S	4	6	3 3/4 x 4 1/2	69.8	1800	B	EL	..	..	76	25	43	2400
40DRC12	M-S	4	6	4 5/8 x 5 1/4	90	1200	B	EL	..	..	98	34	53	4800
40DJH18*	S	4	6	3 3/4 x 4 1/2	79.8	1800	B	EL	..	..	90	29	48	3500
50DFB12	M-S	4	6	5 x 6	121	1200	B	EL	..	..	110	37	77	6200
50DWD18*	S	4	6	4 1/4 x 4 3/4	107.5	1800	B	EL	..	..	93	31	52	4100
60DFC12	M-S	4	6	5 1/4 x 6	134	1200	B	EL	..	..	112	37	77	6300
60DRC18*	S	4	6	4 5/8 x 5 1/4	130	1800	B	EL	..	..	98	34	53	4800
75DFE12	M-S	4	6	5 5/8 x 6	156	1200	B	EL	..	..	113	33	77	6400
100WKD12	M-S	4	6	6 1/4 x 6 1/2	189	1200	B	EL	..	..	118	44	79	9000
100DFD18*	S	4	6	5 1/2 x 6	204	1800	B	EL	..	..	112	37	77	6700
125DV12	M-S	4	8	6 1/4 x 6	252	1200	B	EL	..	..	114	44	76	11000
140DV12*	S	4	8	6 1/4 x 6	252	1200	B	EL	..	..	117	44	76	11000
200DV18*	S	4	8	6 1/4 x 6	359	1800	B	EL	..	..	120	44	76	11500

*Marine and stationary engine-generator sets. * For emergency or stand-by use only. FMB Models—Fairbanks-Morse engine; DAC and WKD Models—Waukesha engine; All Others—Hercules engine.*

Washington Iron Works
1500 Sixth Avenue, South
Seattle, Washington

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3-125	M-S	4	3	9 x 12 1/2	90	400	BS	A	..	O	128	37 1/2	82 1/2	13500
4-125	M-S	4	4	9 x 12 1/2	120	400	BS	A	..	O	142	37 1/2	82 1/2	14700
5-125	M-S	4	5	9 x 12 1/2	150	400	BS	A	..	D	137	37 1/2	82 1/2	16500
6-125	M-S	4	6	9 x 12 1/2	200	450	BS	A	..	D	151	37 1/2	82 1/2	18000
6-125TS	M-S	4	6	9 x 12 1/2	285	450	BS	A	TC	D	151	37 1/2	82 1/2	19000
8-125	M-S	4	8	9 x 12 1/2	270	450	BS	A	..	D	181	37 1/2	82 1/2	21000
8-125TS	M-S	4	8	9 x 12 1/2	380	450	BS	A	TC	D	181	37 1/2	82 1/2	22000
3-13	M-S	4	3	10 1/4 x 13 1/2	120	360	BS	A	..	O	136	40	89	15800
4-13	M-S	4	4	10 1/4 x 13 1/2	160	360	BS	A	..	O	158	40	89	18500
6-13	M-S	4	6	10 1/4 x 13 1/2	260	390	BS	A	..	D	166	40	89	23000
6-13TS	M-S	4	6	10 1/4 x 13 1/2	345	390	BS	A	TC	D	166	40	89	24000
8-13	M-S	4	8	10 1/4 x 13 1/2	350	390	BS	A	..	D	202	40	89	26500
8-13TS	M-S	4	8	10 1/4 x 13 1/2	460	390	BS	A	TC	D	202	40	89	27500
4-15	M-S	4	4	11 1/2 x 15	200	327	BS	A	..	D	169	46	100	27000
6-15	M-S	4	6	11 1/2 x 15	330	360	BS	A	..	D	189	46	100	31500
6-15TS	M-S	4	6	11 1/2 x 15	450	360	BS	A	TC	D	189	46	100	33000
8-15	M-S	4	8	11 1/2 x 15	440	360	BS	A	..	D	233	46	100	40500
8-15TS	M-S	4	8	11 1/2 x 15	600	360	BS	A	TC	D	233	46	100	43000
6-160	M-S	4	6	12 3/4 x 16	400	360	BS	A	..	D	209	50	106 1/2	42000
6-160TS	M-S	4	6	12 3/4 x 16	585	360	BS	A	TC	D	209	50	106 1/2	44000
8-160	M-S	4	8	12 3/4 x 16	550	360	BS	A	..	D	249	50	106 1/2	53000
8-160TS	M-S	4	8	12 3/4 x 16	780	360	BS	A	TC	D	294	50	106 1/2	55000
6-18	M-S	4	6	14 1/2 x 18	500	300	BS	A	..	D	245	56	120 1/2	62500
6-18TS	M-S	4	6	14 1/2 x 18	710	300	BS	A	TC	D	245	56	120 1/2	65000
8-18	M-S	4	8	14 1/2 x 18	665	300	BS	A	..	D	292	56	120 1/2	80000
8-18TS	M-S	4	8	14 1/2 x 18	945	300	BS	A	TC	D	292	56	120 1/2	82500
6-20	M-S	4	6	16 x 20	640	277	BS	A	..	D	264	61	133	82000
6-20TS	M-S	4	6	16 x 20	885	277	BS	A	TC	D	264	61	133	85000
8-20	M-S	4	8	16 x 20	850	277	BS	A	..	D	321	61	133	103000
8-20TS	M-S	4	8	16 x 20	1180	277	BS	A	TC	D	321	61	133	106000

Engines have open combustion chamber. All are for both marine and stationary use. Lengths and weights are for marine engines. All marine models are direct reversing except 3 and 4-cyl. units which have reverse gear.

Waukesha Motor Company
Waukesha, Wisc.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
180-DAC	S-P	4	4	3 1/16 x 3 3/4	35	2400	B	H-EL	..	..	31	19	28	475
185-DAC	S-P	4	6	3 1/16 x 3 3/4	51	2200	B	EL	..	..	..	..	..	..
190-DLC	S-P	4	6	3 3/4 x 4	76	2400	B	H-EL	..	..	42 3/4	22	29 1/16	868
135-DL	S-P	4	6	4 1/8 x 5	135	2800	B	EL	..	..	..	..	..	1075
140-DK	S-P	4	6	4 1/2 x 5 1/2	147	2200	B	EL	..	..	..	..	..	..
148-DK	S-P	4	6	5 1/4 x 6	198	2000	B	EL-G	..	..	56	27	48 1/2	2320
6-WAKD	S-P-M	4	6	6 1/4 x 6 1/2	240	1600	B	EL-G	..	..	68	37 3/8	56 5/8	3800
6-NKD	S-P	4	6	7 x 8 1/4	263	1050	B	EL-G	..	..	..	..	..	7245
6-LRD	S-P	4	6	8 1/2 x 8 1/2	386	1050	B	EL-G	..	..	127 1/4	51	69 1/8	10300

All models suitable for stationary and mobile use. Hp. ratings are maximum. Rpm at maximum Hp. is shown.

White-Roth Machine Corp.
Lorain, Ohio

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
LD	S	2	1	7½ x 8	22	600	B	A	..	..	72	48	53	2600
OD	S	2	1	9½ x 10	33	450	B	A	..	..	88	58	59	3630
AD	S	2	1	13 x 13	57	325	B	A	..	..	110	74	68	8300

Witte Engine Works
Oil Well Supply Division, U. S. Steel Company
Kansas City, Missouri

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AD	S-P	4	1	3¼ x 4½	4-6.8	1200-1800	DM-B	H-EL	..	..	23½	23½	32⅝	450
BD	S-P	4	1	4¼ x 6	8	900	DM-B	H	..	..	45½	33⅛	27⅜	930
LD	S-P	4	1	4¾ x 5¼	9	1350	DM-B	H-EL	..	..	28⅞	28	43½	842
CD	S-P	4	1	5 x 8	12.5	750	B	H	..	..	52¾	36	36⅜	1352

All engines have pre-combustion chambers. Designations indicate a series built in several different models determined by type of cooling equipment and power take-off.

Wolverine Motor Works, Inc.
Bridgeport, Conn.

Model	Use	Cycle	No. of Cyl.	Bore & Stroke In.	Cont. H.P.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
....	M	2	2	6⅜ x 8⅜	25- 30	425-500	BS	A	..	O	79¾	..	..	4035
....	M	2	3	6⅜ x 8⅜	38- 45	425-500	BS	A	..	O	92⅜	..	..	4975
....	M	2	4	6⅜ x 8⅜	50- 60	425-500	BS	A	..	O	105½	..	..	6000
....	M	2	6	6⅜ x 8⅜	75- 90	425-500	BS	A	..	D	112	..	..	7200
....	M-S	4	3	8½ x 10½	110-120	600-650	BS	A	..	S	97	..	..	8300
....	M-S	4	4	8½ x 10½	145-160	600-650	BS	A	..	S	110	..	..	9500
....	M-S	4	5	8½ x 10½	185-200	600-650	BS	A	..	S	124	..	..	10400
....	M-S	4	6	8½ x 10½	225-240	600-650	BS	A	..	S	137	..	..	11600
....	M-S	4	8	8½ x 10½	300-320	600-650	BS	A	..	S	180*	..	..	13800
....	M-S	4	3	8½ x 12½	75- 90	360-400	O	A	..	O	117	..	..	11300
....	M-S	4	4	8½ x 12½	100-120	360-400	O	A	..	O	133⅜	..	..	12000
....	M-S	4	4	8¾ x 13	120-140	360-400	O	A	..	O	143⅛	..	..	13500
....	M	4	4	9¼ x 14	140-160	360-400	O	A	..	O	146½	..	..	15000
....	M	4	5	9¼ x 14	175-200	360-400	O	A	..	D	127¼	..	..	18500
....	M	4	6	9¼ x 14	210-240	360-400	O	A	..	D	143⅝	..	..	19000
....	M	4	8	9¼ x 14	280-320	360-400	O	A	..	D	176	..	..	24000

**With reverse and 2 to 1 reduction gear.*

Worthington Corporation
Harrison, New Jersey

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
BB5	S-P	4	5	8 x 10½	150	600	..	A	..	..	..	..	..	...
BB6	S-P	4	6	8 x 10½	180	600	..	A	..	..	..	..	..	...
CC5	S-P	4	5	10⅝ x 14½	345	514	..	A	..	..	..	..	..	...
CC6	S-P	4	6	10⅝ x 14½	410	514	..	A	..	..	..	..	..	...
CC7	S-P	4	7	10⅝ x 14½	480	514	..	A	..	..	..	..	..	...
CC8	S-P	4	8	10⅝ x 14½	550	514	..	A	..	..	..	..	..	...
SCC5	S-P	4	5	10⅝ x 14½	515	514	..	A	TC	..	..	..	..	...
SCC6	S-P	4	6	10⅝ x 14½	615	514	..	A	TC	..	..	..	..	...
SCC7	S-P	4	7	10⅝ x 14½	720	514	..	A	TC	..	..	..	..	...
SCC8	S-P	4	8	10⅝ x 14½	825	514	..	A	TC	..	..	..	..	...
DD5	S	4	5	13¼ x 17½	435	360	..	A	..	..	..	..	..	...
DD6	S	4	6	13¼ x 17½	525	360	..	A	..	..	..	..	..	...
DD7	S	4	7	13¼ x 17½	615	360	..	A	..	..	..	..	..	...
DD8	S	4	8	13¼ x 17½	700	360	..	A	..	..	..	..	..	...
SDD5	S	4	5	13¼ x 17½	660	360	..	A	TC	..	..	..	..	...
SDD6	S	4	6	13¼ x 17½	790	360	..	A	TC	..	..	..	..	...
SDD7	S	4	7	13¼ x 17½	925	360	..	A	TC	..	..	..	..	...
SDD8	S	4	8	13¼ x 17½	1055	360	..	A	TC	..	..	..	..	...
DH5	S-P	4	5	12 x 14	480	600	..	A	..	..	..	..	..	...
DH6	S-P	4	6	12 x 14	575	600	..	A	..	..	..	..	..	...
DH7	S-P	4	7	12 x 14	670	600	..	A	..	..	..	..	..	...
DH8	S-P	4	8	12 x 14	765	600	..	A	..	..	..	..	..	...
SDH5	S-P	4	5	12 x 14	720	600	..	A	TC	..	..	..	..	...
SDH6	S-P	4	6	12 x 14	865	600	..	A	TC	..	..	..	..	...
SDH7	S-P	4	7	12 x 14	1010	600	..	A	TC	..	..	..	..	...
SDH8	S-P	4	8	12 x 14	1155	600	..	A	TC	..	..	..	..	...
DR5	S	4	5	13¼ x 17½	550	450	..	A	..	..	..	..	..	...
DR6	S	4	6	13¼ x 17½	660	450	..	A	..	..	..	..	..	...
DR7	S	4	7	13¼ x 17½	770	450	..	A	..	..	..	..	..	...
DR8	S	4	8	13¼ x 17½	880	450	..	A	..	..	..	..	..	...
SDR5	S	4	5	13¼ x 17½	825	450	..	A	TC	..	..	..	..	...
SDR6	S	4	6	13¼ x 17½	990	450	..	A	TC	..	..	..	..	...
SDR7	S	4	7	13¼ x 17½	1155	450	..	A	TC	..	..	..	..	...
SDR8	S	4	8	13¼ x 17½	1320	450	..	A	TC	..	..	..	..	...
EH5	S	4	5	16 x 20	730	360	..	A	..	..	..	..	..	...
EH6	S	4	6	16 x 20	880	360	..	A	..	..	..	..	..	...
EH7	S	4	7	16 x 20	1025	360	..	A	..	..	..	..	..	...
EH8	S	4	8	16 x 20	1170	360	..	A	..	..	..	..	..	...
SEH5	S	4	5	16 x 20	1100	360	..	A	TC	..	..	..	..	...
SEH6	S	4	6	16 x 20	1320	360	..	A	TC	..	..	..	..	...
SEH7	S	4	7	16 x 20	1540	360	..	A	TC	..	..	..	..	...
SEH8	S	4	8	16 x 20	1760	360	..	A	TC	..	..	..	..	...

All engines have open type combustion chambers. Dual fuel optional. All ratings are for 60 cycle speeds. For 375 rpm 50 cycle speed, horsepower ratings are increased in direct proportion to the increase in speed. Naon-supercharged ratings at 80 bmep. PSI. except BB-5 and BB-6 which are 75 bmep. Increased horsepower ratings available with bmep's above 120 psi.

Imported Diesels

Brush Aboe, Inc.
Empire State Building
350 Fifth Avenue
New York 1, N. Y.

Model		Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
Petter	AVA1	SP	4	1	3.15 x 4.33	5¼	1800	Bryce	EL-H	..	..	29¾	21	30	390
"	AVA2	SP	4	2	3.15 x 4.33	10½	1800	"	EL-H	..	..	36½	21	31¾	558
"	AV1	SP	4	1	3.15 x 4.33	6	1800	"	EL-H	..	..	29¾	20½	29¼	406
"	AV2	SP	4	2	3.15 x 4.33	12	1800	"	EL-H	..	..	36½	20½	31¾	598
"	B2T	S-P	4	2	4.33 x 4.33	18	1500	"	EL-H	..	..	32½	24¾	33	1198
"	B3T	S-P	4	3	4.33 x 4.33	27	1500	"	EL-H	..	..	39½	24¾	33	1477
"	B4T	S-P	4	4	4.33 x 4.33	36	1500	"	EL-H	..	..	45¾	24¾	33	1737
Meadows	4DC-330	S-P	4	4	4.724 x 4.724	60	1800	Cav	EL	..	..	38	22½	40	950
"	4DC-420	S-P	4	4	5½ x 5½	66	1600	"	EL	..	..	42¾	31½	43½	1500
"	4DC-630	S-P	4	6	5½ x 5½	100	1600	"	EL	..	..	52½	30⅝	41⅝	1790
"	Greenville	M	4	4	5½ x 5½	65	1650	"	EL	..	..	70½	35	47	2200
"	Probisher	M	4	6	5½ x 5½	100	1650	"	EL	..	..	82½	35	47	2550
Petter	AV2M	M	4	2	3.15 x 4.33	10	1500	Bryce	EL-H	..	..	48	20	29¼	760
Meadows	970	S-P	4	6	5.9 x 5.9	150	1500	Cav	EL	..	..	63¾	32½	47½	3500
"	970S	S-P	4	6	5.9 x 5.9	200	1500	"	EL	T-C	..	68	32½	47½	3900
Mirrlees	J6	S-M	4	6	9¾ x 10½	360	720	Bryce	A	T-C	..	..	..	..	....
"	JS8	S-M	4	8	9¾ x 10½	665	720	"	A	..	..	..	..	..	....
"	JV12	S-M	4	12	9¾ x 10½	724	720	"	A	..	..	..	..	..	....
"	JSV16	S-M	4	16	9¾ x 10½	1310	720	"	A	T-C	..	..	..	..	....
"	K8	S-M	4	8	15 x 18	990	428	"	A	..	..	..	..	..	....
"	KVS12	S-M	4	12	15 x 18	2160	428	"	A	T-C	..	..	..	..	....
National	M4A8	S	4	8	6 x 8½	198	1000	Cav	A-EL	..	..	96¾	36	57¾	7160
"	R4AU6	S	4	6	9 x 12	405	600	"	A	T-C	..	127	54⅝	81⅞	18060
"	B4AU8	S	4	8	17 x 21½	1728	333	"	A	T-C	..	298	106	135	133880

The above list is only representative of the sizes and types that Brush Aboe, Inc. manufacture; engines up to 3000 hp. are available.

Bolinders Company, Inc.
33 Rector Street
New York 6, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
W3M15	M	2	1	4¾ x 4¾	8–10	900	O	A-RL	..	G	37	..	..	415
W3M25	M	2	2	4¾ x 4¾	16–20	900	O	A-EL	..	G	44⅞	..	..	930
W7M15	M	2	1	7⅛ x 7⅛	25	800	O	A-EL	..	G	43⅝	..	..	1525
W7M25	M	2	2	7⅛ x 7⅛	50	800	O	A-EL	..	G	49⅛	..	..	1985
W7M45	M	2	4	7⅛ x 7⅛	100	800	O	A-EL	..	G	86⅝	..	..	3300
M42EB	M	2	2	....	80– 100	450– 600	O	A	..	O	100	..	..	8250
M43EB	M	2	3	....	120– 155	450– 600	O	A	..	O	121	..	..	10500
M44EB	M	2	4	....	160– 210	450– 600	O	A	..	O	141	..	..	128000
M45EB	M	2	5	....	200– 265	450– 600	O	A	..	O	155	..	..	1480
M46EB	M	2	6	....	240– 320	450– 600	O	A	..	O	166	..	..	17200
M44E	M	2	4	....	160– 210	450– 600	O	A	..	D	104	..	..	11700
M45E	M	2	5	....	200– 265	450– 600	O	A	..	D	117	..	..	13500
M46E	M	2	6	....	240– 320	450– 600	O	A	..	D	129	..	..	15100
M47E	M	2	7	....	280– 375	450– 600	O	A	..	D	145	..	..	16500
M44I	M	2	4	....	300– 420	300– 425	O	A	..	D	163	..	..	32200
M45I	M	2	5	....	370– 520	300– 425	O	A	..	D	185	..	..	36600
M46I	M	2	6	....	450– 630	300– 425	O	A	..	D	203	..	..	40000
M47I	M	2	7	....	520– 730	300– 425	O	A	..	D	232	..	..	46300
M33M	M	2	4	....	560– 730	220– 300	O	A	..	D	215	..	..	64600
M45M	M	2	5	....	700– 910	220– 300	O	A	..	D	246	..	..	78200
M46M	M	2	6	....	840–1100	220– 300	O	A	..	D	274	..	..	84800
M47M	M	2	7	....	980–1280	220– 300	O	A	..	D	312	..	..	99000
M48M	M	2	8	....	1120–1460	220– 300	O	A	..	D	343	..	..	109000

M models have open type combustion chambers. Weight for MEB models include reverse gear. Models W3 and 7 are surface ingition engines of Bolinder manufacture. Balance are of Atlas Polar design sold through Bolinders.

Burmeister & Wain American Corporation
17 Battery Place
New York 4, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
450-VT-110	M-S	2	4	19.7 x 43.3	1680	170	O	A	..	D	..	..	..	....
550-VT-110	M-S	2	5	19.7 x 43.3	2100	170	O	A	..	D	..	..	..	....
650-VT-110	M-S	2	6	19.7 x 43.3	2520	170	O	A	..	D	..	..	..	....
750-VT-110	M-S	2	7	19.7 x 43.3	2940	170	O	A	..	D	..	..	..	....
850-VT-110	M-S	2	8	19.7 x 43.3	3360	170	O	A	..	D	..	..	..	....
950-VT-110	M-S	2	9	19.7 x 43.3	3780	170	O	A	..	D	..	..	..	....
1050-VT-110	M-S	2	10	19.7 x 43.3	4200	170	O	A	..	D	..	..	..	....
1150-VT-110	M-S	2	11	19.7 x 43.3	4620	170	O	A	..	D	..	..	..	....
1250-VT-110	M-S	2	12	19.7 x 43.3	5040	170	O	A	..	D	..	..	..	....
462-VT-115	M-S	2	4	24.4 x 45.3	2400	150	O	A	..	D	..	..	..	....
562-VT-115	M-S	2	5	24.4 x 45.3	3000	150	O	A	..	D	..	..	..	....
662-VT-115	M-S	2	6	24.4 x 45.3	3600	150	O	A	..	D	..	..	..	....
762-VT-115	M-S	2	7	24.4 x 45.3	4200	150	O	A	..	D	..	..	..	....
862-VT-115	M-S	2	8	24.4 x 45.3	4800	150	O	A	..	D	..	..	..	....
962-VT-115	M-S	2	9	24.4 x 45.3	5400	150	O	A	..	D	..	..	..	....
1062-VT-115	M-S	2	10	24.4 x 45.3	6000	150	O	A	..	D	..	..	..	....
1162-VT-115	M-S	2	11	24.4 x 45.3	6600	150	O	A	..	D	..	..	..	....
1262-VT-115	M-S	2	12	24.4 x 45.3	7200	150	O	A	..	D	..	..	..	....
474-VT-140	M-S	2	4	29.1 x 55.1	3500	125	O	A	..	D	..	..	..	....
574-VT-140	M-S	2	5	29.1 x 55.1	4375	125	O	A	..	D	..	..	..	....
674-VT-140	M-S	2	6	29.1 x 55.1	5250	125	O	A	..	D	..	..	..	....
774-VT-140	M-S	2	7	29.1 x 55.1	6125	125	O	A	..	D	..	..	..	....
874-VT-140	M-S	2	8	29.1 x 55.1	7000	125	O	A	..	D	..	..	..	....
974-VT-140	M-S	2	9	29.1 x 55.1	7875	125	O	A	..	D	..	..	..	....
1074-VT-140	M-S	2	10	29.1 x 55.1	8750	125	O	A	..	D	..	..	..	....
1174-VT-140	M-S	2	11	29.1 x 55.1	9625	125	O	A	..	D	..	..	..	....
1274-VT-140	M-S	2	12	29.1 x 55.1	10500	125	O	A	..	D	..	..	..	....

Not listed are various types of 4-cycle, 2-cycle and 2-cycle double acting engines. Inclusion of "S" in designation indicates stationary model; "F" indicates marine.

Crofton Industrial Diesel Engines
San Diego 1, California

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
4-1A		4	1	3 3/16 x 3 15/16	4	1500	B	H-EL	..	..	28*	19	27 1/2	235
5-1W	M-S	4	1	3 3/16 x 3 15/16	5-7	1500	B	H-EL	..	..	38 1/4	17 5/8	26 5/8	246
7-1W	M-S	4	1	3 7/16 x 3 15/16	7-9	1500	B	H-EL	..	..	38 1/4	17 5/8	26 5/8	266
9-1W	M-S	4	1	3 7/16 x 3 15/16	9-11	1500	B	H-EL	..	..	38 1/4	17 5/8	26 5/8	275

** Includes starting handle. Ricardo type precombustion system is used.*

Klockner-Humboldt-Deutz
Diesel Energy Corporation
47 West Street
New York 6, N.Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MAH711	S-P-M	4	1	3 5/16 x 4 3/16	6.0	1500	O	H	..	..	31 1/2	22 1/2	34 1/2	375
MAH914	S-P-M	4	1	3 15/16 x 5 1/2	11	1500	O	H	..	..	40 1/2	28 1/2	29	693
MAH916	S-P-M	4	1	4 3/4 x 6 5/16	16	1300	O	H	..	..	45 1/2	33	31	965
MAH220	S-P	4	1	5 7/8 x 7 7/8	22	1000	O	H-A	..	..	52 1/2	37	35	1698
A1L514*	S-P-M	4	1	4 3/8 x 5 1/2	12.5	1500	O	H-EL	..	..	22	23 1/2	40	728
A2L514*	S-P-M	4	2	4 3/8 x 5 1/2	25	1500	O	H-EL	..	..	27	27	37 1/2	915
A3L514*	S-P-M	4	3	4 3/8 x 5 1/2	37.5	1500	O	H-EL	..	..	30	26	37 1/2	1014
A4L514*	S-P-M	4	4	4 3/8 x 5 1/2	60	1800	B	EL	..	..	44	29	41	1213
A6L514*	S-P-M	4	6	4 3/8 x 5 1/2	90	1800	B	EL	..	..	54	33	40	1610
A6L614*	S-P-M	4	6V	4 3/8 x 5 1/2	90	1800	B	EL	..	..	44	47	36	1670
A8L614*	S-P-M	4	8V	4 3/8 x 5 1/2	120	1800	B	EL	..	..	47	47	36	1930
F1L514*	P	4	1	4 3/8 x 5 1/2	15	1650	O	H-EL	..	..	22	23 1/2	40	728
F2L514*	P	4	2	4 3/8 x 5 1/2	30	1600	O	H-EL	..	..	27	27	37 1/2	850
F3L514*	P	4	3	4 3/8 x 5 1/2	45	1600	O	H-EL	..	..	30	26	37 1/2	945
F4L514*	Truck	4	4	4 3/8 x 5 1/2	82-90	2300	B	EL	..	..	44	29	41	1043
F6L514*	Truck	4	6	4 3/8 x 5 1/2	120-130	2250	B	EL	..	..	54	33	40	1373
F6L614*	Truck	4	6V	4 3/8 x 5 1/2	120-130	2250	B	EL	..	..	44	47	36	1595
F8L614*	Truck	4	8V	4 3/8 x 5 1/2	160-175	2250	B	EL	..	..	47	47	36	1870
T2M425	S-P-M	2	2	5 7/8 x 9 7/8	52	600	O	A	M	..	51	36	57	4190
T3M425	S-P-M	2	3	5 7/8 x 9 7/8	80	600	O	A	M	..	61	36	57	5180
T4M425	S-P-M	2	4	5 7/8 x 9 7/8	105	600	O	A	M	..	71	36	57	6173
T4M525	S-P-M	2	4V	7 7/8 x 9 7/8	200	625	B	A	..	D	61	59	57	5070
T8M525	S-P-M	2	8V	7 7/8 x 9 7/8	400	625	B	A	..	D	81 1/2	59	57	8050
T4M233	S-P-M	2	4	8 5/8 x 13	250	500	B	A	M	D	103	47	73	10900
T8M233	S-P-M	2	8V	8 5/8 x 13	500	500	B	A	M	D	110	63	77	15540

*Performances stated are valid for continuous operation and can be exceeded for one hour by 10 per cent. All dimensions for stationary models. Model TM 425 has Roots type blower; TM 233 has centrifugal type. * Air-cooled engines with turbulence chambers in cylinder heads.*

Lister-Blackstone, Incorporated
Graybar Building, 420 Lexington Avenue
New York 17, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3-1	S	4	1	3 3/4 x 5 1/2	3 1/2	650	B	H	..	..	35 1/2	24	40	750
5-1	S	4	1	4 1/2 x 5 1/2	6	650	B	H	..	..	35 1/2	24	40	760
10-2	S	4	2	4 1/2 x 5 1/2	12	650	B	H	..	..	50	24	40	1130
FR1	M-S	4	1	3 3/4 x 4 1/2	8	1500	B	H-EL	..	O	26 7/16	22 1/2	35 5/8	750
FR2	M-S	4	2	3 3/4 x 4 1/2	16	1500	B	H-EL	..	O	31 11/16	22 1/2	35 5/8	970
FR3	M-S	4	3	3 3/4 x 4 1/2	24	1500	B	H-EL	..	O	37	22 1/2	35 5/8	1100
FR4	M-S	4	4	3 3/4 x 4 1/2	32	1500	B	H-EL	..	O	43 1/4	22 1/2	35 5/8	1270
FR5	M-S	4	6	3 3/4 x 4 1/2	48	1500	B	H-EL	..	O	53 3/4	22 1/2	35 5/8	1590
18-2	M-S	4	2	4 1/2 x 5 1/2	21	1200	B	H-A-EL	..	O	47 3/4	25	40 1/2	1625
27-3	M-S	4	3	4 1/2 x 5 1/2	30	1200	B	H-A-EL	..	O	57 1/2	25	40 1/2	2040
38-4	M-S	4	4	4 1/2 x 5 1/2	40	1200	B	H-A-EL	..	O	66 1/8	25	40 1/2	2275
616	M-S	4	6	4 1/2 x 5 1/2	63	1200	B	A-EL	..	O	74 1/2	32	43 1/2	3000

MWM Benz Diesel Engines
Ernest L. Frankl Associates
22 E. 40th St., New York 16, N.Y.

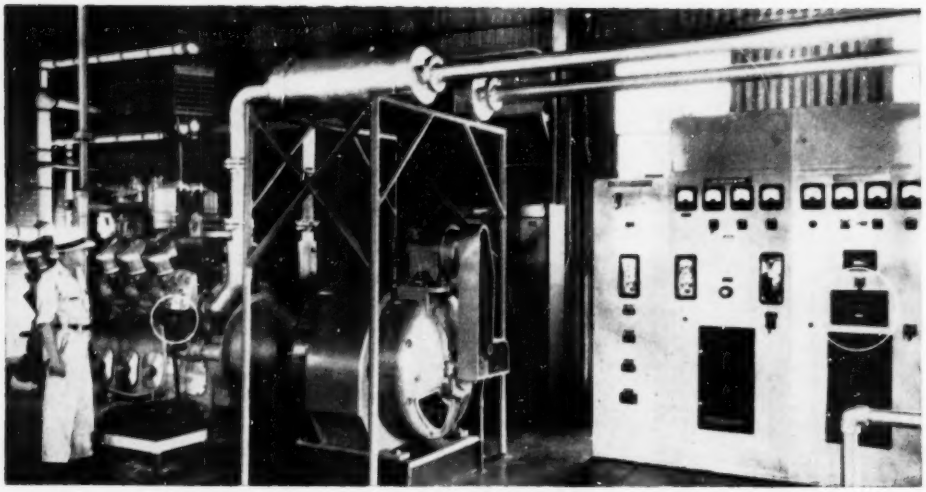
Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
KDW415E	M-S-P	4	1	3 15/16 x 5 5/16	6- 12	750-1500	D/G	EL-H	..	D	26	21	37	700
KD415Z	M-S-P	4	2	3 15/16 x 5 5/16	12- 24	750-1500	D/G	EL-H	..	D	29	21	37	930
KD415D	M-S-P	4	3	3 15/16 x 5 5/16	18- 36	750-1500	D/G	EL-H-A	..	D	37	21	40	1170
TD15	M-S-P	4	2	4 31/64 x 5 5/16	15- 30	750-1500	B/G	EL-H	..	D	26	22	37	990
RH418Z	M-S-P	4	2	5 1/2 x 7 7/8	55	1350	B/G	EL-A	..	D	29	29	45	1330
RH418D	M-S-P	4	3	5 1/2 x 7 7/8	82- 90	1350-1500	B/G	EL-A	..	D	38	29	45	1660
RH418V	M-S-P	4	4	5 1/2 x 7 7/8	110- 120	1350-1500	B/G	EL-A	..	D	48	29	45	1990
RH418S	M-S-P	4	6	5 1/2 x 7 7/8	165- 180	1350-1500	B/G	EL-A	..	D	64	29	45	2720
RH418A	M-S-P	4	8	5 1/2 x 7 7/8	220- 240	1350-1500	B/G	EL-A	..	D	78	29	45	3450
RH422Z	M-S-P	4	2	5 15/16 x 8 11/16	26- 45	800-1000	B/G	EL-A	..	D	42	37	52	3060
RH422D	M-S-P	4	3	5 15/16 x 8 11/16	54- 68	800-1000	B/G	EL-A	..	D	51	37	52	3730
RH422V	M-S-P	4	4	5 15/16 x 8 11/16	72- 90	800-1000	B/G	EL-A	..	D	61	37	52	4260
RH422S	M-S-P	4	6	5 15/16 x 8 11/16	110- 150	800-1100	B/G	EL-A	..	D	81	37	52	5860
RH422S	M-P-S	4	6	5 15/16 x 8 11/16	145- 200	800-1100	B/G	EL-A	TC	D	81	37	52	6520
RH230D	M-S-P	4	3	8 15/16 x 11 13/16	75- 100	375- 500	B/G	A	..	D	77	42	67	7850
RH230V	M-S-P	4	4	8 15/16 x 11 13/16	100- 133	375- 500	B/G	A	..	D	91	42	67	9500
RH230S	M-S-P	4	6	8 15/16 x 11 13/16	150- 290	375- 750	B/G	A	..	DO	120	42	67	12830
RH230S	M-S-P	4	6	8 15/16 x 11 13/16	260- 310	500- 600	B/G	A	TC	DO	120	42	67	13490
RH134S	M-S-P	4	6	10 1/4 x 13 1/16	330- 400	500- 600	B/G	A	..	DO	128	58	77	17970
RH134S	M-S-P	4	6	10 1/4 x 13 1/16	460- 550	500- 600	B/G	A	TC	DO	128	58	77	18630
RH335S	M-S-P	4	6	9 15/16 x 13 3/16	300- 360	500- 600	B/G	A	..	DO	128	48	81	14550
RH335S	M-S-P	4	6	9 15/16 x 13 3/16	440	500	B/G	A	TC	DO	128	48	81	15210
RH348V	M-S-P	4	4	12 15/16 x 18 3/16	265- 295	300- 333	B/G	A	..	D	128	57	106	27450
RH348S	M-S-P	4	6	12 15/16 x 18 3/16	400- 500	300- 375	B/G	A	..	DO	170	59	106	37480
RH348S	M-S-P	4	6	12 15/16 x 18 3/16	700	375	B/G	A	TC	DO	170	59	106	38470
RH348A	M-S-P	4	8	12 15/16 x 18 3/16	530- 660	300- 375	B/G	A	..	O	221	59	106	46520
RH348A	M-S-P	4	8	12 15/16 x 18 3/16	920	375	B/G	A	TC	O	221	59	106	47990

"DG" Fuel equipment made by Deckel, Germany; "BG" made by Bosch, Germany.

Sulzer Bros. Ltd., New York
50 Church Street
New York 7, N. Y.

Model	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3BA22	S	4	3	8.67 x 12.6	210	600	O	A	TC	..	..	..	..	...
4BA22	S	4	4	8.67 x 12.6	275	600	O	A	TC	..	..	..	..	...
5BA22	S	4	5	8.67 x 12.6	350	600	O	A	TC	..	..	..	..	...
6BA22	S	4	6	8.67 x 12.6	450	600	O	A	TC	..	..	..	..	...
8BA22	S	4	8	8.67 x 12.6	600	600	O	A	TC	..	..	..	..	...
6BA29	S	4	6	11.4 x 14.4	700	500	O	A	TC	..	..	..	..	...
7BA29	S	4	7	11.4 x 14.4	800	500	O	A	TC	..	..	..	..	...
8BA29	S	4	8	11.4 x 14.4	950	500	O	A	TC	..	..	..	..	...
4T36	S	2	4	14.4 x 23.6	800	300	O	A	..	..	..	..	..	...
5T36	S	2	5	14.4 x 23.6	1000	300	O	A	..	..	..	..	..	...
6T36	S	2	6	14.4 x 23.6	1200	300	O	A	..	..	..	..	..	...
8T36	S	2	8	14.4 x 23.6	1600	300	O	A	..	..	..	..	..	...
4TPF48	S	2	4	18.9 x 27.5	1400	250	O	A	..	..	..	..	..	...
5TPF48	S	2	5	18.9 x 27.5	1750	250	O	A	..	..	..	..	..	...
6TPF48	S	2	6	18.9 x 27.5	2100	250	O	A	..	..	..	..	..	...
7TPF48	S	2	7	18.9 x 27.5	2450	250	O	A	..	..	..	..	..	...
8TPF48	S	2	8	18.9 x 27.5	2800	250	O	A	..	..	..	..	..	...
10TPF48	S	2	10	18.9 x 27.5	3500	250	O	A	..	..	..	..	..	...
12TPF48	S	2	12	18.9 x 27.5	4200	250	O	A	..	..	..	..	..	...
6SF72	S	2	6	28.3 x 35.4	4500	187	O	A	..	..	..	..	..	...
8SF72	S	2	8	28.3 x 35.4	6000	187	O	A	..	..	..	..	..	...
10SF72	S	2	10	28.3 x 35.4	7500	187	O	A	..	..	..	..	..	...
12SF72	S	2	12	28.3 x 35.4	9000	187	O	A	..	..	..	..	..	...
4TW24	M	2	4	9.46 x 15.75	300	400	O	A	..	G	..	..	..	...
6TW24	M	2	6	9.46 x 15.75	450	400	O	A	..	G	..	..	..	...
6TD24	M	2	6	9.46 x 15.75	450	400	O	A	..	..	..	..	..	...
6TD29	M	2	6	11.4 x 19.75	600	300	O	A	..	..	..	..	..	...
7TD29	M	2	7	11.4 x 19.75	700	300	O	A	..	..	..	..	..	...
8TD29	M	2	8	11.4 x 19.75	800	300	O	A	..	..	..	..	..	...
9TD29	M	2	9	11.4 x 19.75	900	300	O	A	..	..	..	..	..	...
5TD36	M	2	5	14.4 x 23.6	750	250	O	A	..	..	..	..	..	...
6TD36	M	2	6	14.4 x 23.6	900	250	O	A	..	..	..	..	..	...
7TD36	M	2	7	14.4 x 23.6	1050	250	O	A	..	..	..	..	..	...
8TD36	M	2	8	14.4 x 23.6	1200	250	O	A	..	..	..	..	..	...
10TD36	M	2	10	14.4 x 23.6	1500	250	O	A	..	..	..	..	..	...
5TPD48	M	2	5	18.9 x 27.5	1500	225	O	A	..	..	..	..	..	...
6TPD48	M	2	6	18.9 x 27.5	1800	225	O	A	..	..	..	..	..	...
10TPD48	M	2	10	18.9 x 27.5	3000	225	O	A	..	..	..	..	..	...
12TPD48	M	2	12	18.9 x 27.5	3600	225	O	A	..	..	..	..	..	...
6SD60	M	2	6	23.6 x 41	3000	150	O	A	..	..	..	..	..	...
7SD60	M	2	7	26.6 x 41	3500	150	O	A	..	..	..	..	..	...
8SD60	M	2	8	23.6 x 41	4000	150	O	A	..	..	..	..	..	...
9SD60	M	2	9	23.6 x 41	4500	150	O	A	..	..	..	..	..	...
10SD60	M	2	10	23.6 x 41	5000	150	O	A	..	..	..	..	..	...
6SD72	M	2	6	28.3 x 49.3	4200	125	O	A	..	..	..	..	..	...
7SD72	M	2	7	28.3 x 49.3	4900	125	O	A	..	..	..	..	..	...
8SD72	M	2	8	28.3 x 49.3	5600	125	O	A	..	..	..	..	..	...
9SD72	M	2	9	28.3 x 49.3	6300	125	O	A	..	..	..	..	..	...
10SD72	M	2	10	28.3 x 49.3	7000	125	O	A	..	..	..	..	..	...
11SD72	M	2	11	28.3 x 49.3	7700	125	O	A	..	..	..	..	..	...
12SD72	M	2	12	28.3 x 49.3	8400	125	O	A	..	..	..	..	..	...
6LDA19	P	4	6	7.5 x ...	420	1100	O	EL	TC	..	..	..	..	...
6LDA22	P	4	6	8.67 x ...	570	950	O	EL	TC	..	..	..	..	...
6LDA25	P	4	6	9.85 x ...	735	850	O	EL	TC	..	..	..	..	...
8LDA25	P	4	8	9.85 x ...	960	850	O	EL	TC	..	..	..	..	...
6LDA28	P	4	6	11.0 x ...	915	750	O	EL	TC	..	..	..	..	...
8LDA28	P	4	8	11.0 x ...	1200	750	O	EL	TC	..	..	..	..	...
12LDA31	P	4	12	12.3 x ...	2250	935#	O	EL	TC	..	..	..	..	...

#—Number of R.P.M. of the generator.



Automatic controls (circled on gas engine and panel) used in gas pumping operation by Texas Eastern Transmission Corp., Lebanon, Ohio.

Automatic Engine Controls and Their Application

by William L. Stelter
Chief Engineer, Synchro-Start Products Inc.

APPLICATION of automatic controls to the operation of internal combustion engines have been tremendously increased during the last ten years, with a resultant saving of untold manhours and equipment from damage.

Engine operation, when combined with one of the automatic control systems, becomes as flexible as an electric motor and often more reliable because it is not dependent on any outside source which might fail at the most critical time.

Discussed here are some of the applications, operation, and service and maintenance procedures for automatic controls in general.

Applications

Stand-by power is probably where automatic control finds its greatest use. Most hospitals and radio stations, for example, have emergency generator sets, as a power failure here would constitute an emergency rather than a mere inconvenience. Such installations, where power is required at all times, are now designed with automatic controls—a forethought instead of an afterthought.

Fighting frost in agricultural areas is a more recent application of automatic controls. Here an engine driven propeller, mounted on a tower, starts up and drives the air at this higher level toward the ground whenever the temperature drops below a predetermined point. Use of engines in this case instead of electric motors saves the cost of substantial standby charges which are levied by all power companies when a motor of equivalent horsepower is connected to their lines, but seldom used.

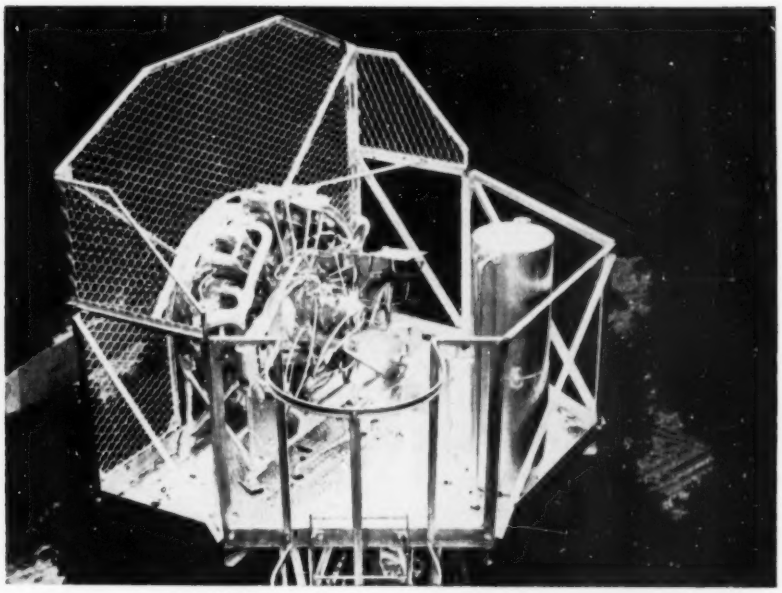
Modern fire fighting equipment has also taken advantage of the protection afforded by automatic controls. Controls have been developed that meet specifications of insurance underwriters for the control of engine driven fire pumps as used in industrial plants, airports, warehouses, etc. These units are necessarily more elaborate than standard industrial controls, as on certain occasions large investments are staked on these engines starting when required and being up to speed in a matter of seconds. Such panels are designed primarily to start on a pressure drop in the sprinkler system.

In addition they can be started from remote stations located at strategic points. To insure that the unit is at top efficiency at all times, it is started by means of a time clock three times a week and run for a period of 15 or 20 min. An automatic recorder keeps a permanent record of the units operations which can be examined periodically by insurance inspectors.

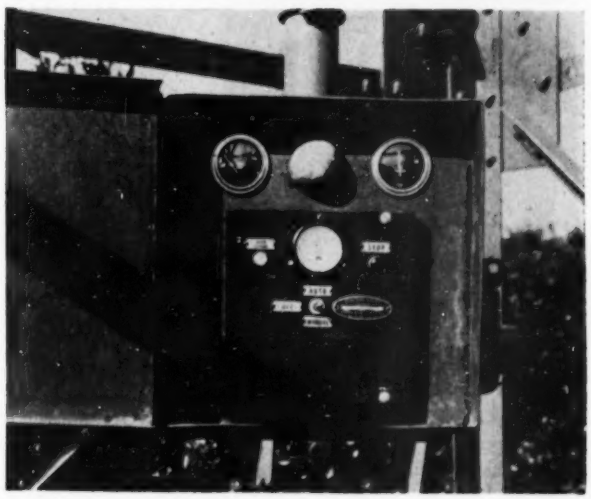
Gas and oil pipeline booster stations have especially found automatic controls advantageous.

One installation of this type consists of two engine driven compressors whose function is to maintain constant pressure in the pipeline during periods of heavy demands. One engine starts when the pressure falls to a predetermined point. If this engine is unable to maintain the necessary pressure the other engine cuts in to help take the load.

Safety controls on these engines warn the operator of any abnormal conditions that occur in their opera-



Wind machines in citrus groves fight frost. Above are two views of such a unit built by the Shaffer Tool Works, Brea, Calif., using Guiberson radial aircooled diesels.



Automatic control panel for a wind machine mounted, near ground for convenience.

tion. Records for the first year show that this system maintained a more constant system pressure over a long period of time than was possible under manual control. Furthermore, a 75 per cent saving of man hours was achieved.

Oil field pumping engines are especially suited to the application of automatic control, as it makes it possible for one man to handle a whole field of engines.

Due to conservation practices, pumping is permissible only for certain lengths of time. Control by means of a time clock has been worked out so that an engine will be started when pumping is supposed to begin and stopped after the time allowed for pumping has elapsed. Various signaling devices are incorporated to summon the operator in case an engine failed to start or failed while running.

An extreme example of what can be done with automatic controls involves the use of microwave radio transmitters, in addition to the engine panels. Although such an installation involves a considerable amount of equipment, maximum efficiency and convenience can be attained. All engines would be completely controlled from one central location. An operator is not only able to start and stop any engine from the master control board, but is immediately informed if any engine fails.

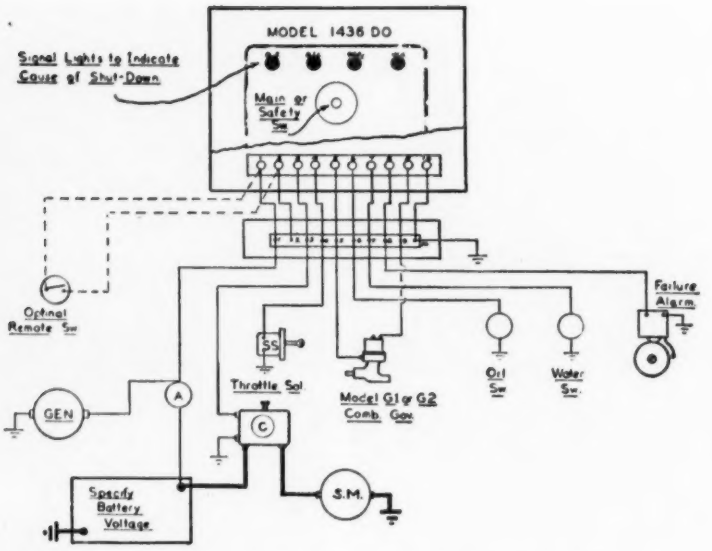
From the foregoing applications it will be seen that the use of automatic controls greatly reduces labor costs by almost eliminating constant engine attendance and further increases the efficiency of the installation by eliminating the human element in times of emergency and actual absence of the attendant from the job.

Operation of Automatic Control

While individual installations may vary somewhat, a general idea of automatic control operation may be gained from the following description.

When power is needed of the engine, a switch is closed that automatically opens and closes all circuits necessary for cranking the engine, such as water valves, fuel valves, cranking circuit, solenoid-operated governor controls, etc. As soon as the engine starts, the control set causes the starting motor to stop cranking and breaks all circuits necessary for the cranking period while holding closed those circuits necessary for the running of the engine.

If the engine fails to start at once, cranking will continue for about 25 seconds, after which the starting motor circuit will be interrupted for a short period of perhaps 10 seconds and then reconnected for approximately 7 seconds.



At left is "The Universal", a panel for control of full automatic engine operation including recording of events. Schematic diagram, above, is typical of a control set for diesel operation. Numerous variations are possible to meet a specific need.

This interrupted cranking cycle will be repeated until the engine starts or until five efforts have been made, after which the control set will disconnect the current to the engine and energize the circuit to the alarm, signal light, or stand-by engine.

As has been mentioned, this is a typical automatic control and the cranking cycle may vary somewhat for different installations.

In the event the engine stops due to lack of fuel, the control will attempt to re-start the engine by going through one short cranking cycle before shutting off. The main control switch or the safety switch must be opened for approximately five minutes after any shut-down caused by abnormal conditions before controls will return to normal conditions to obtain another full starting cycle.

Should an abnormal condition occur while the engine is running, such as overheating, oil pressure failure, engine overspeed, etc., it will be automatically shut-down by the control set. When a shut-down is caused by any of these conditions or due to lack of fuel, a circuit is energized to operate an alarm or start a stand-by engine.

Service and Maintenance

Most any engine can be adapted to automatic control, provided it can start readily under all conditions to which it may be subjected and come up to speed and full power quickly without the use of manually operated primers, heaters, glow plugs, compression releases or mechanical fuel switchovers. Most modern diesel engines meet these requirements.

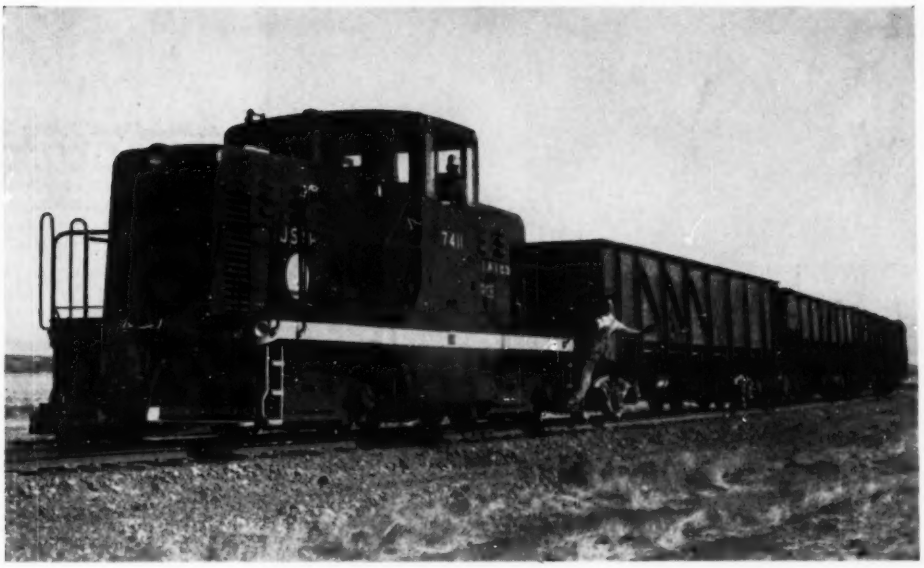
After an automatically controlled plant has been installed it must be kept at peak efficiency to insure starting when needed. An operator will sometimes use various means at his command to start a balky engine, such as hand priming or some special manipulation. Automatic controls are incapable of performing these operations hence it is important that the engine always be able to start readily in a normal manner.

Engines and batteries should be tested and inspected at least once a week. Fuel supply and water level should also receive attention during the weekly inspection.

Most control systems require very little service and adjustment of the electrical units, and will usually outlast the engine. About the only attention they require is an occasional cleaning of the contact points when burned or pitted, and keeping all connections clean and tight. Above all, keep the battery well charged and in good condition.

Any engine that stands idle for a few days may be hard to start, refuse to start, or may not be able to come up to full speed and assume its load at once during an emergency. Therefore, all engines should be test-run periodically to circulate the oil and warm the water enough to drive out condensation from the cylinders and crankcase, and to insure that the engine is primed with fuel at all times. A fifteen minute run is usually sufficient to accomplish this, although the time varies with different engines.

There are dependable automatic controls, which when properly applied will cause the engine to meet practically any special requirements. Savings attendant to the use of such controls will rapidly amoritize their cost while at the same time rendering improved and trouble free service.



"Sagebrush" may be labeled "U. S. Air Force" but it doesn't "fly". Recent orders limited loading to five coal cars due to "runway" depreciation and to avoid locomotive over-heating. All-weather operation is maintained without instrument piloting.

Now for a change of pace read about —

"Sagebrush", Mountain Home's 10-mph. Rocket

by Dick LaCoste

COMMUTING personnel of the 1706th Air Base Group, Mountain Home Air Force base, can testify that it's a rare day when one sees anything but horizon on the 14 mile desert trip between the base and Mountain Home.

Such lonely stretches reportedly do strange things to the minds of men.

It probably isn't odd, therefore, that many find themselves fascinated by a distant spot moving toward them, growing, shimmering in the sun, and looking for all the world like a mirage.

Then heaving and shoving through the wilds comes the "Sagebrush", Idaho's own version of the "Toonerville Trolley", a short, squat diesel-equipped switching locomotive of 380 horsepower.

To set all minds at ease, this isn't a product of heat prostration. Nor is it a practical joke. On the contrary, the prosaic little switcher constitutes the lifeline of Mountain Home Air Force base.

Here are a few facts from the January records that underscore its importance. During the month the "Rocket" ran 170 hours delivering and returning 125 cars to the base. Cars have carried everything from coal to canned food. They have burned 851 gallons of diesel fuel covering 994 miles.

Despite their impressive record, the engineers confide that they really don't know whether the hundreds of jackrabbits they see during a run are being chased by the engine or vice-versa.

Partial reason for the good humored score is that average speed on the eleven-mile run between the base and Mountain Home is an unspectacular rate considerably under ten mph.

Also, if the load is large it is necessary to hook on the road's other locomotive and combine powers to accomplish the job.

During activities at the time of World War II, main line trains transferred to the base's rails. The line is now independent. It makes its own run between the base and Mountain Home—that run only.

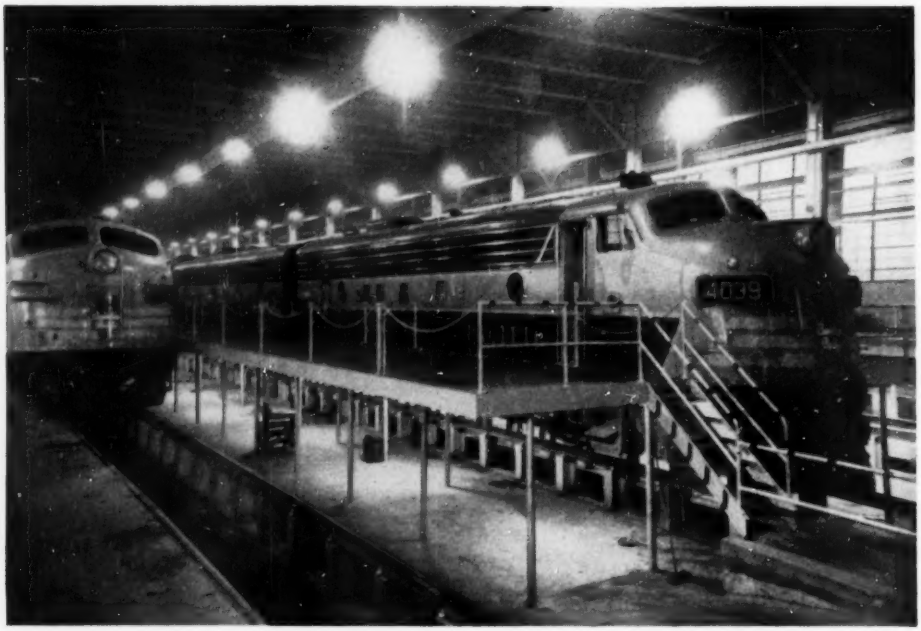
If the line were privately owned and had such a title as "president", the distinction would go to 1st Lt. Lloyd W. Johnston, of Cut Bank, Montana. Set up as it is under the Air Force, Johnston's title is "Transportation Officer", rather than the more familiar and impressive "railroad president". Johnston was a railroad man in civil life also.

Actual piloting of the "mighty" locomotives is handled by John A. Cox, Mountain Home, and Sgt. Ollie B. Blackwell, Whiteville, N. C. Brakeman is James C. Strauth, Boise.

Cox, a civilian, operated locomotives as a G.I. in Europe during World War II. He has operated practically every type of locomotive ever built.

"Toonerville Trolley" days are soon to be part of the past. If Lieutenant Johnston's dreams come true, a new era is in store for the line of the "Rockets". He has ordered a newer type diesel weighing 80 tons. The present not so impressive locomotives are 44 tonners.

When that bright day comes, the entire staff of the "Line of the Rockets" will probably go along on the first run just to jeer at the shocked jackrabbits.



Access and good lighting is provided at all levels. Running gear can be checked below and platform is at cab and engineroom height.

Canadian Pacific Gears Up for Diesel Repair

by Hugh G. Jarman

A NEW million-dollar diesel service plant opened a few months ago at Alyth Yard in Calgary, Alberta, Canada. It is the first one of its kind opened in Canada, all others having been re-constructed or converted steam roundhouses.

This new plant, says Mr. G. E. Mayne, general superintendent of the Alberta district, "Will be used to service the new fleet of 208-ft. giant diesel streamliners which will roll more than 4800 tons of loaded freight cars over the Rocky Mountain hump without a grunt."

These locomotives have been in regular freight service all this winter between Calgary and Revelstoke, representing about one half the units required to completely dieselize the territory. When the balance are received, passenger as well as freight service will be handled by diesel. The first order for 28, now all delivered, was for 1500-hp. units.

The 208-ft. locomotives now on hand cost over $950,000 and are part of the new $68,000,000 five year development plan devoted to this type of power, which was announced by the C.P.R. management in the early part of 1950.

The Calgary-Revelstoke switchover from steam to diesel is the second major area to be worked on since the announcement of the plan. When a visitor makes an inspection of the new service plant he is obliged to pass the old steam round-house. Here will be found among other steam power, the Giant 5900's, largest in the British Empire, whose eventual death sentence for mountain work has been given by the diesels.

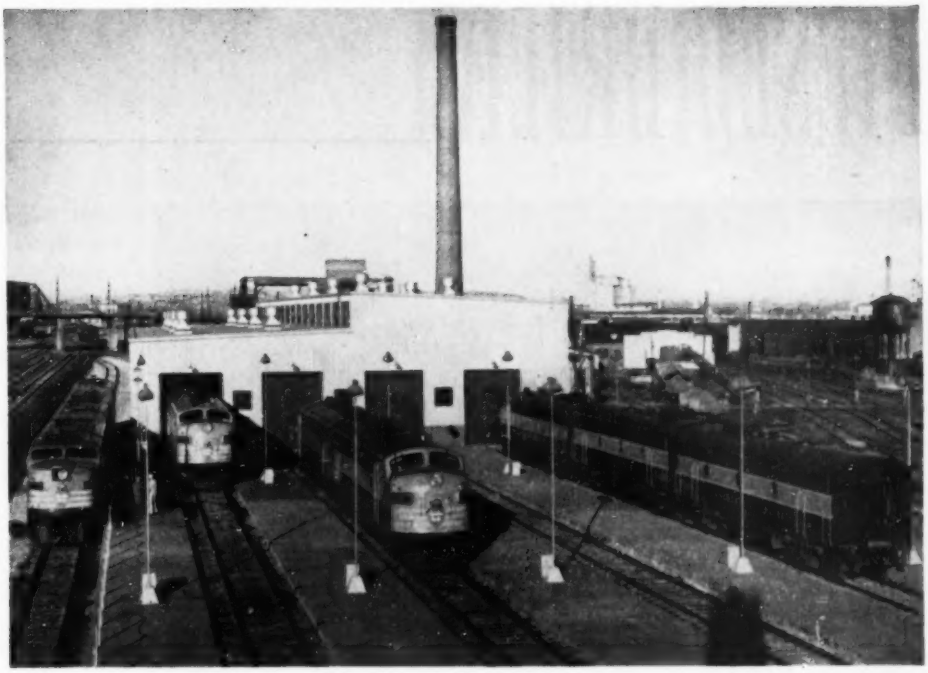
The diesel service plant at Alyth is part of the long-range program and is built to service and do running repairs on all diesels that will run west of Calgary, as well as the nine switchers which have been working the Calgary yard since 1944.

To take full advantage of diesel ability on the 263-mile run from Calgary to Revelstoke the running schedule is set for one diesel to make the complete run, the locomotive going right through.

To get the most out of this expensive equipment the plan is to so schedule freight movement that a locomotive hauling a westbound train into Revelstoke can hook onto an eastbound freight for Calgary almost immediately on arrival.

"All we have to do is give her a drink (of oil), and away again", said one of the train crew. The steam engines which were formerly used on the Mountain division, will be stepped back onto the next run coming east, a run 323 miles long, extending from Calgary east to Swift Current. This is what they term the step-back method of retiring steam power. It means each time the diesels replace steam power the steam power steps down a step, and the steam engines replaced also step down until it reaches the oldest steam freight or switching engines. These are then retired to the junk pile.

One thing which would escape the



Diesels in front of the new million-dollar service plant are all set for the mountain run between Calgary and Revelstoke.

eye of the layman is that everytime a run is dieselized, the passing track has to be lengthened to accommodate the longer trains which diesels are capable of pulling.

The pattern of the Calgary-Revelstoke conversion is the one which has been developed by the Canadian Pacific from its first use of diesel power back in 1943 when five switchers were put into service in the Montreal Yards.

Dieselization is by complete territories, first on freight and then on passenger, rather than the type of showmanship commonly used by many railroads, which puts a "Streamliner" on a "name" passenger train.

The diesel shop out of Calgary, which is the key to the operation, is a building 260 ft. long with four pits running its full length, each of which will accommodate a 208-ft. diesel. Platforms to the height of cab and engine room doors allow the turnaround work to be speeded up. Incorporated in the general heating system of the shop are sections where the air is especially purified of all dust particles, for the cleaning of air filters and inspection of locomotive parts.

Light in the plant is excellent with the south wall almost entirely of plate glass 12 by 17 ft., most of which is special heat absorbing glass. An airchanging system exhausts all burned gasses from the engines when they are being run for checks.

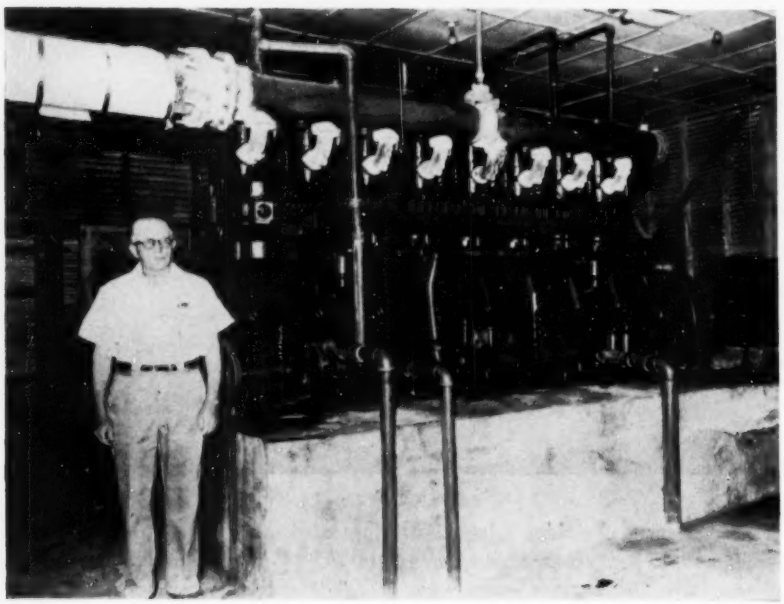
The diesels fuel up from platforms outside the plant and the oil is piped there from a 175,000-gal. storage tank nearby. Ice and sand service is also done here.

The general construction of the shop is of asbestos siding on steel frame. There is excellent indirect lighting under the platform giving the mechanic clear non-shadowed lighting when working under the locomotives. Also included in the shop is a parts storage stock room, as well as storage tanks for lubricating oil (three for clean oil of 5000-gal. capacity each, and one of 4000-gal. capacity for dirty oil), and a complete oil testing laboratory.

Shop conversion and training of personnel in the proper maintenance of diesels has been an enormous problem for the railroads to surmount in their changeover from steam. The Canadian Pacific is to be congratulated for their progressive and realistic approach to this problem by this installation at Calgary, built from the ground up especially for diesels. They are thus assuring themselves of maximum return for this expensive equipment.

Locomotive gets personal attention by two young ladies employed at the plant to help clean up the big units.

DIESEL BRIEFS



Low Cost Irrigation Pumping with Gas Engines

Santa Cruz Farms, a division of D'Arrigo Bros. of California with wholesale terminals in New York and Boston, farms over 1100 acres near Elroy, Arizona, to produce vegetables alfalfa and cotton. In this arid region, you cannot take a chance on water. The source of supply must be dependable, and the method of delivery must be sure.

Santa Cruz Farms assured itself of a source by drilling three deep wells and equipping each well with a National Supply Company Atlas Model 45, natural-gas engine, driving a Wintroath deep-well pump. Two of the pumps use flat-belt drive, while the other is driven through a Johnson Model JH-300 gear head.

The first engine was installed in 1949, the second in 1950 and the third in 1951. According to Mr. M. H. Coon, superintendent, "The unit installed in 1949 has operated a total of 12,400 hours with total operating cost averaging only 86 cents an hour. Maintenance has been nominal—changing spark plugs every three months."

Diesel Locomotives in Brazil

Forty diesel-electric locomotives have been ordered from the International General Electric Company, Inc., for heavy freight work in Brazil, it was announced recently.

Purchased by the Central Railways of Brazil, the 107-ton locomotives will be built at the G-E Erie, Pa. works. Each will be powered with American Locomotive Company V-12 diesel engines, having a rating of 1600 horsepower.

The locomotives will be used on the meter-gage (39⅜ in.) lines. The conversion from steam to diesel-electric power will begin with the shipment of the first locomotive early in 1953 and will continue through 1954.

A.E.R.A. Meeting

The Automotive Engine Rebuilders Association is holding it annual conference at The Plaza hotel in San Antonio, Texas, May 5, 6, and 7.

Subjects covered in the sessions include: "Quality Control of Machine Shop Operation", "What the Factory Expects of the Engine Rebuilder", "Hot Rod Rebuilding", etc. There will be a special ladies program, a "Texas night" and an annual banquet and dance.

Conference booths will be arranged in the mezzanine, lounge and ball room of the hotel for use of manufacturers of automotive replacement parts and machine shop equipment. Booths are to be manned at all times during conference periods.

Worthington Changes Name

At the annual stockholders' meeting it was voted to change the name of Worthington Pump and Machinery Corporation to Worthington Corporation. The corporation has extended its manufacturing activities into many other fields than pumps, and feels the name change will help clear up any erroneous impressions.

No corporation policies or practices will be affected in any way by the name change.

Diesels Step-Up Indo-China Rice Crop

President Truman in his recent message to Congress cited an example of how diesel powered pumps were helping Indo-China increase its rice crop at a nominal figure.

Heart of the rice producing area in Indo-China is the Red River Valley, which is dependent upon electricity to operate irrigation pumps. Power lines to these pumps run through Communist held territory and have, of course, been cut.

To alleviate this situation, Harold E. Schwartz, an American technical advisor from South Dakota, had some diesel engines brought in to pump the water. As a result, 15,000 farm families have 25,000 acres of rice they didn't have last year.

Cost of the diesel equipment—

DIESEL BRIEFS

$75,000. Value of the rice crop in the area—$2,000,000. This is a good example of how a little ingenuity and a small outlay can produce large scale results—not to mention the suffering eliminated that food shortages always cause in war areas.

Military Engine Standards

The military announces that by July 1, 1952 they will have specifications and standards on industrial gasoline engines of 3 and 4-in. bores. Standardization improves interchangability of parts and will reduce inventories from 1187 to 59 standardized parts. To expand production base, manufacturers are urged to provide facilities for building. To qualify as suppliers, engines produced must pass tests. There has been talk of diesel standardization and perhaps "Coming events cast their shadows, etc., etc."

Rock Island Goes Diesel

The Rock Island Lines announced recently that its entire passenger service is now diesel-powered, with the delivery of six new road diesel engines.

The dieselization program started in 1936, and after a letup due to materials shortages during World War II, got under way again at the end of the conflict. The company expects to have its freight and switching services, with the exception of a few freight trains on one division, diesel powered by the end of this year.

The six new 2250-hp. diesels were built by the Electro-Motive Division of General Motors Corporation.

Bacharach Enters Diesel Service Tool Field

Bacharach Industrial Instrument Company has entered the diesel service tool field through the purchase of all inventories and production facilities of Curtiss & Smith Mfg. Co., of Pottstown, Pa.

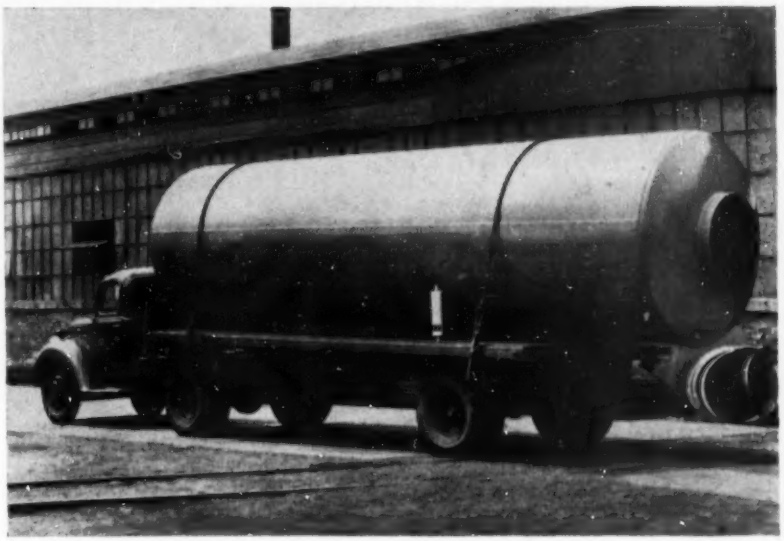
Initially Bacharach will make all service tools previously manufactured by Curtiss & Smith, which comprises tools and equipment for servicing the complete line of Cummins and Detroit Diesel engines, as well as service tools for GM truck and coach overhaul. The company's immediate aim is to build up an inventory of frequently purchased tools to a level adequate to satisfy customers' delivery requirements.

DEMA Meeting

The third annual meeting of the advertising managers, sales promotion managers and public relations directors of the members of the Diesel Engine Manufacturers Association took place March 13th at the Union League Club of Chicago.

About 35 executives of the various companies comprising DEMA were represented, and discussions pertained to the problems of the respective fields in which these executives operate.

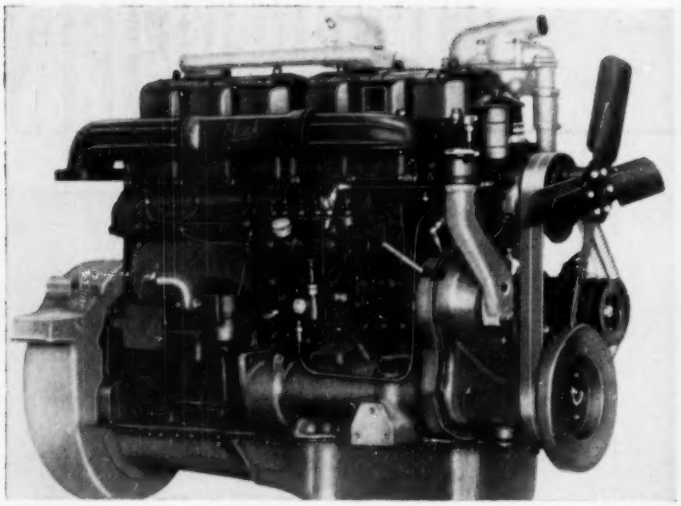
Highlights of the meeting were a presentation at the noonday luncheon by Volney B. Fowler, assistant to the president of the Electro-Motive Division, General Motors Corporation, whose subject was "The Dieselization of American Railroads", (see this issue, DIESEL POWER AND DIESEL TRANSPORTATION, for article, "Facts on Today's Railroads") and a talk by Robert B. Craig of DEMA on the subject of the "R. E. A. and the Diesel Industry."



Mutt and Jeff of the Snubber World

Showing the range of acoustical devices made by Burgess-Manning Company of Libertyville, Illinois to silence the roar of exhaust from internal combustion engines are the two snubbers above. The big fellow is an STC-30 snubber weighing 9000 lbs., has a diameter of 72 in. and is 318 in. long. The little snubber is an STC-1, weighing 6 lbs.

These snubbers are designed to prevent, rather than to muffle, exhaust noise and to quiet the discharge of blowers and vacuum pumps. They convert high energy slugs of exhaust gases to a continuous flow by means of successive snubbing stages, dissipating the energy of the slugs so that the gases reach the atmosphere in a comparatively smooth stream.



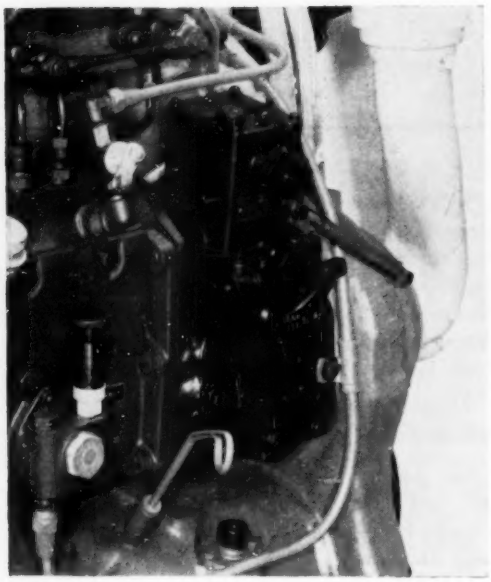


Fig. 1. Mack's END 672 truck diesel showing flange-mounted and direct gear-driven injection pump and governor assembly. Fig. 2 at right shows close-up of injection pump drive housing and governor.

Governing Mack's Diesels

by Merrill C. Horine
Mack Mfg. Corp., New York, N. Y.

How a compensating control system provides torque control, speed droop and automatic variation of injection timing in addition to speed control.

COMBINING simple manual control with automatic regulation to achieve efficient operation under the radically and often rapidly fluctuating demands upon automotive power plants, the control system used in connection with diesel engines in Mack trucks and buses features some interesting self-compensating characteristics. The scheme is designed to maintain steady operating speed sensitive to the driver's control and protection of the engine against both over-speed and over-feed of fuel. It provides a uniform idling speed, a speed droop characteristic, giving the driver feel of the load, and automatic engine shut-off in case of failure of the engine lubricating system.

Mack diesels are of the 4-stroke type with energy cell combustion system and Bosch multiple-unit injection pump and hydraulic pintle-type nozzles.

Driver's End of System

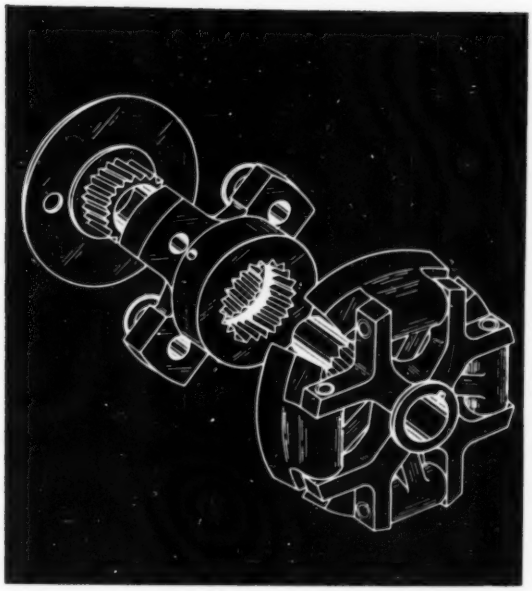
Driving control is by means of the usual accelerator (treadle type) operated by the right foot which controls the speed of the engine in direct proportion to the extent to which it is depressed.

The accelerator does not act directly upon the injection pump metering control or rack. Instead, it operates through the governor. Thus, instead of determining the volume of fuel injected per cycle directly, the position of the accelerator controls the speed at which the engine shall operate, independent of load, within the capabilities of the engine. The governor also, of course, limits the maximum speed of the engine and controls its idling speed.

Aside from the accelerator, the only other manual controls are the normal stop control, which causes the metering rack of the injection pump to move to no-delivery position and the emergency stop control.

Engine End of System

AUTOMATIC TIMING DEVICE—Automatic regulation of the operation of Mack diesels is provided by two separate devices, namely, the Woodward hydraulically-actuating governor and the Mack "Synchrovance" coupling. The latter, illustrated in Figs. 3 and 4, is a simple centrifugal device which advances or retards the injection pump driveshaft in relation to its drive through a range of 11 to 14½ degrees (depending on the model) of crankshaft travel in accordance with engine speed. When at rest and up to approximately 750 rpm. the Synchrovance maintains the injection pump port-closing time at full retard. As the speed is increased the timing is progressively advanced until, at from 1500 to 1900 rpm. (according to the model)



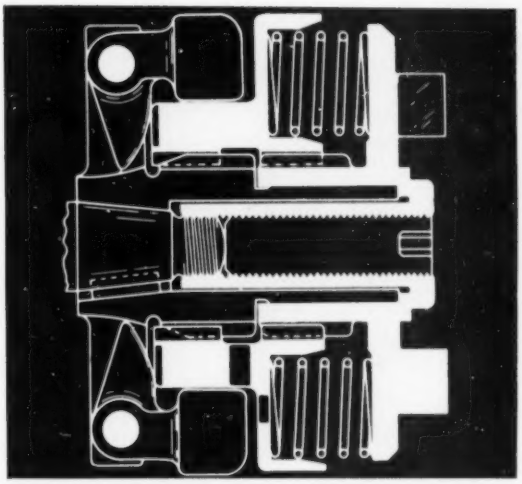


Fig. 3 Perspective sketch of Synchrovance coupling exploded to show three elements.

Fig. 4 Sectional drawing of Synchrovance. Driving end—right; driven end—left.

the full advance is attained, which timing is of course then maintained through further increases in speed.

This variable injection timing regulation serves to provide a degree of flexibility and smoothness of operation which would be impossible with fixed timing. In this respect it resembles automatic variable spark timing universally used in automotive gasoline engines. Retarded injection timing at low speed assists starting by delaying injection until maximum compression pressure and therefore maximum air temperature has been reached. It makes slower and smoother idling possible because it obviates the pre-ignition which would occur with fixed advance suitable for the upper range of speeds.

There is a small but worthwhile gain in both power and economy, since timing suited to the speed of the engine provides greater duration of expansion and of course, correspondingly higher expansion ratio. This spells a cooler exhaust, and absence of knocking under heavy load and freedom from smoke.

Operation—Completely automatic and requiring no adjustment or servicing, the Synchrovance acts as the coupling between the injection pump and its drive. It is a rugged assembly comprising three principal elements, namely a driven member rigidly attached to the driving stub shaft from the timing gears, a driving member, forming half of the oldham coupling by which the injection pump is driven and a sliding sleeve connecting the two by skewed splines. These splines are skewed, respectively at opposite hand, so that as the sleeve slides one way or the other, the driving and driven members are displaced rotatively relative to each other. In this manner the timing of the injection pump is advanced or retarded from the driving index. Attached to the driven member are four husky bobweights acting through angular cam extensions upon the flat end of the sliding sleeve, where endwise motion is opposed by springs carried by the driving member.

When the engine is stopped and up to about 750 rpm., the sliding sleeve is retained at the rearward extreme of its travel, giving fully retarded injection timing. As the speed increases above this point, the bobweights expand, pushing the sleeve forward against the springs and advancing the timing until full advance is reached.

GOVERNOR—Far from serving merely as a maximum speed limiter, the governor on Mack diesels performs a variety of useful functions. It provides an extremely responsive speed control since the driver has merely to determine the speed required by the position of the accelerator treadle. Within its capabilities the engine will then be constrained to operate at this speed regardless of variations of load, so long as the accelerator remains in a fixed position.

This is in sharp contrast with control systems on both gasoline and diesel engines in which the accelerator controls directly the metering control or rack and the corresponding throttle of the gasoline engine; and which therefore must be continually adjusted to compensate for different loadings on the engine in order to maintain a constant speed. There is also a desirable cushioning effect of such a governor acting between the accelerator and the injection pump rack, which avoids violent surges of power.

In addition to this, of course, the governor provides a limit on maximum speed and in idling control. The idle control is set for a given rpm. and it maintains the engine speed at that rpm. whenever the accelerator is at rest, regardless of variations in fuel, temperature or engine condition.

Besides these functions with respect to speed, the governor also incorporates what is known as a torque control, whereby the maximum safe torque at low speed is developed and yet excess fuel delivery at high speeds is prevented. In effect, this constitutes a variable limit stop on the fuel pump rack, whereby the maximum fuel delivery in the higher range of speeds is

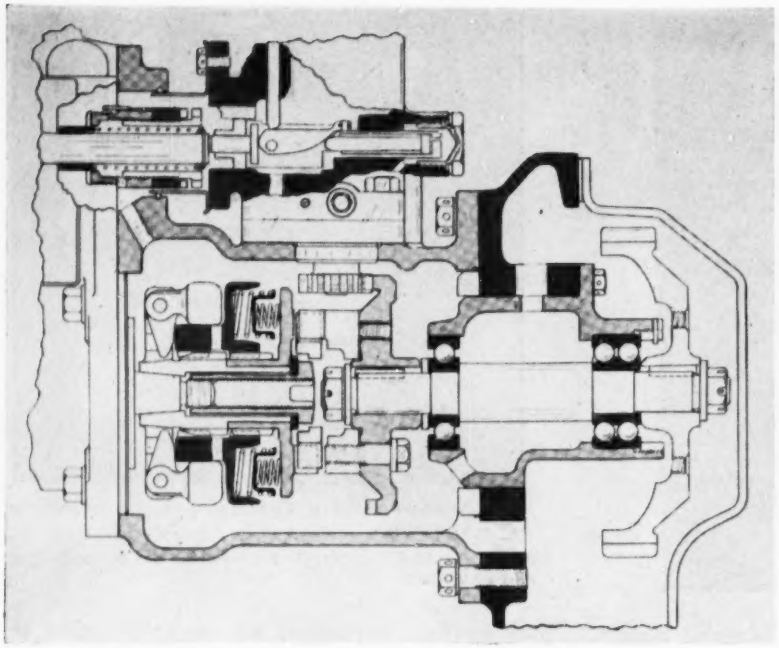


Fig. 5 Injection pump drive layout showing how the Synchrovance unit is integrated in the power train. Injection pump shaft is rotatively displaced from drive shaft by centrifugal and skew gear action to alter timing of the injection pump.

restricted below that available in the lower speeds.

This is in conformance with a fundamental characteristic of diesel engines, which, with a fixed rack position, require a choice or compromise between excess fuel delivery with consequent smoking and carbonizing at high speeds, or the limited torque for acceleration which goes with similarly restricted fuel delivery at low speeds.

By means of a speed droop characteristic the perfect speed regulation in accordance with accelerator position is modified somewhat, in order to give the driver a sense of loading. In operation, this characteristic causes the engine to slow down slightly upon an increase in engine loading and to speed up slightly when the load is suddenly reduced. This action has been found to aid truck drivers materially in the proper use of gear shifts to avoid engine laboring.

Prevention of serious damage to the engine, should the supply of lube oil unexpectedly fail, is also provided by this governor. Since it derives its operating fluid from the engine's lubricating system, failure of this supply of course results in the inability of the governor to maintain hydraulic pressure necessary to hold the fuel pump rack in delivery position, so that the governor stops the engine before serious damage ensues.

Though familiarly classed a hydraulic governor, it actually is centrifugal. It employs hydraulic pressure as the means of actuating the injection pump rack in order to relieve the centrifugal element of load, thus achieving sensitivity and uniformity of action. Schematic arrangement of the governor is shown in Fig. 7.

Action—The entire governor is encased in a small oblong box, mounted directly on top of the injection pump drive casing, being driven by face gears from the injection pump drive.

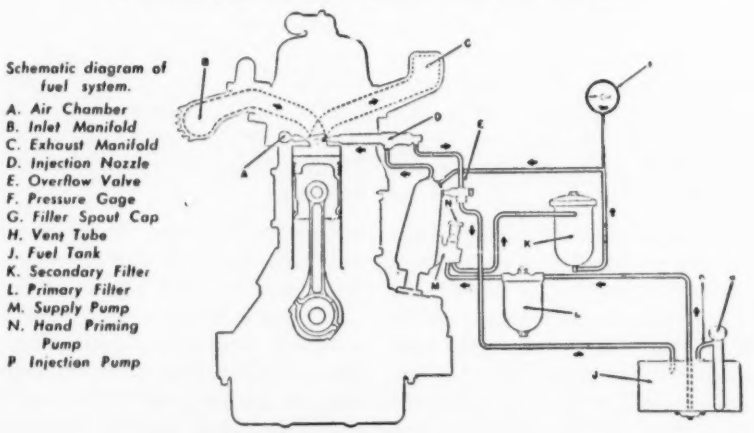
The brain of the device is a small centrifugal element which moves a vertical plunger connected with a spool valve and above with a floating lever acted upon by the governor springs. Oil under pressure is supplied by a small, constantly-running gear pump which draws its supply from the engine lubricating system.

Actuation of the injection pump rack is by means of a cylinder and piston, fluid being admitted, held or released by means of the spool type pilot valve, which is moved by the centrifugal element, in response to changes in speed. A simple spill valve on the connection between the valve and the cylinder serves as the normal stop control.

It is in the peculiar action of the governor springs through the floating lever that this governor is unique. At its center this floating lever bears downwardly on the speed spring in response to the movement of a bell-crank lever at one end, connected with the accelerator. The function of the speed spring is to resist the expansion of the centrifugal element. Variation of its tension through the accelerator connection, acting through the floating lever, accordingly varies the speed at which the centrifugal element overcomes this resistance and expands, moving the injection pump rack to the position required to maintain the selected speed.

At the opposite end of the floating

Fig. 6 Illustrating the various elements of the entire fuel system.



Schematic diagram of fuel system.
A. Air Chamber
B. Inlet Manifold
C. Exhaust Manifold
D. Injection Nozzle
E. Overflow Valve
F. Pressure Gage
G. Filler Spout Cap
H. Vent Tube
J. Fuel Tank
K. Secondary Filter
L. Primary Filter
M. Supply Pump
N. Hand Priming Pump
P Injection Pump

lever there is a connection with a cam lever which rides on the actuating plunger. The whole purpose of this latter arrangement is to provide what is known as torque control and speed droop.

Torque Control—Conventionally controlled diesels have a fixed rack stop which is adjusted for the maximum desired fuel delivery and sealed. Such a fixed limit, however, must be a compromise, for the maximum delivery at high speed should be less than at low speed. If adjusted to suit highspeed requirements, therefore, the rack stop will not permit sufficient delivery at low speed to develop maximum torque. Conversely, setting the stop for full low-speed delivery would result in over-feed at high speed, with consequent smoking, sooting and waste of fuel.

By providing an automatic variation in maximum delivery, according to speed, the torque control accordingly increases the efficiency of operation. It is accomplished by a small piston inside the main servo piston which actuates the rack, plus a cam acting on an auxiliary plunger which bears on the end of the rack. The main servo piston is connected with the main rack plunger. The highspeed rack limit is adjusted to this plunger.

At low speed, when the load is such as to cause the governor to push the rack to this limit without reaching the speed for which the accelerator control is set, continued fluid pressure in the cylinder will cause the auxiliary or torque control piston to move outwardly against the resistance of its own spring.

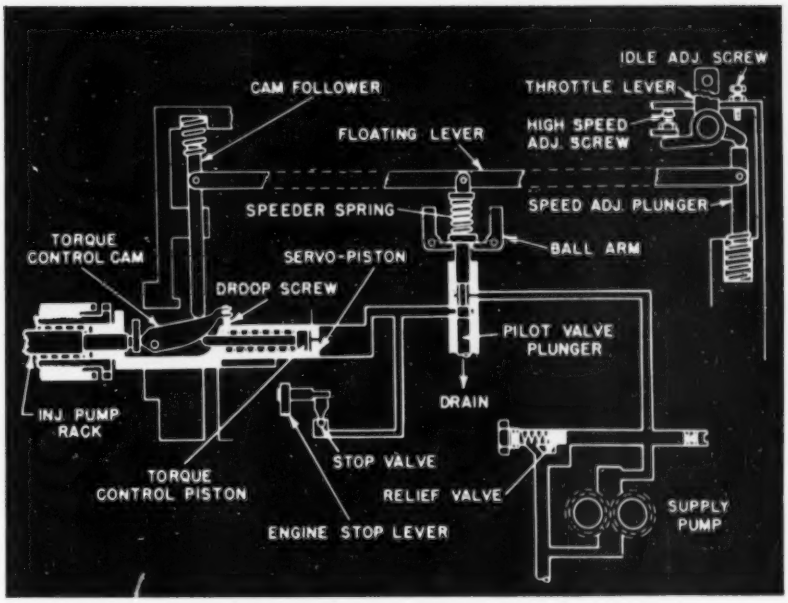


Fig. 7 Schematic diagram of the governor with the various elements of the system shown at governed speed. Details of the interrelated action are described in text.

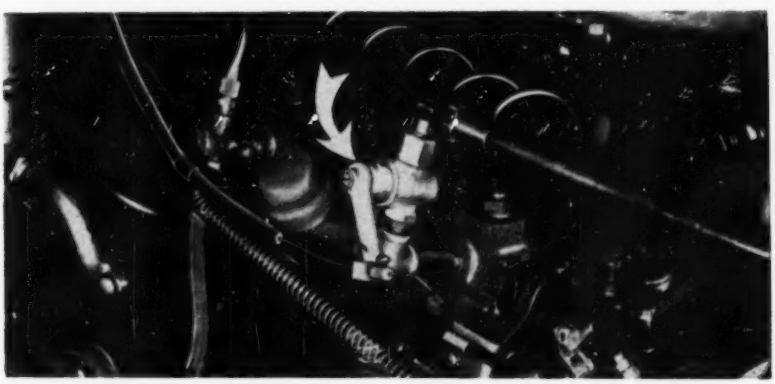
A plunger attached to this piston then protrudes and bears against the cam lever which is thereby lifted so that its cam pushes on the auxiliary rack plunger, moving the rack beyond its high-speed limit to provide slightly increased fuel delivery. This enables the engine to develop greater torque and hence to attain the desired speed more rapidly.

At the same time the cam lever, in rising, bears against a cam follower which raises the floating lever and reduces the pressure of the speed spring. This permits the centrifugal element to expand at a slightly slower speed, thus moving the valve to the top position, maintaining high fuel delivery until the speed corresponding to the speed spring pressure is reached. At this speed, the governor element will expand further, draining the servo cylinder until the auxiliary torque control piston is moved back by its spring, permitting the cam lever to drop and restoring the original pressure on the speed spring.

It is thus seen that the torque control actually serves as a means of hastening acceleration up to the speed for which the accelerator is set, up to 1500 rpm., after which it restores the control to normal.

Droop Action—Owing to the reaction of the torque control on the floating lever and speed spring, it will be seen that when an increase in load tends to retard acceleration in the low-to- medium speed range, thus bringing the torque control into action, the cam lever weakens the speed spring slightly so that the engine slows down slightly and momentarily or until the torque control can accelerate the engine. This is the speed droop action which serves to give the driver a desirable feel of the load.

Fig. 8 Positive shut-off in case of emergency is provided by a manually controlled valve that shuts off the fuel supply. The emergency stop is used in truck applications.



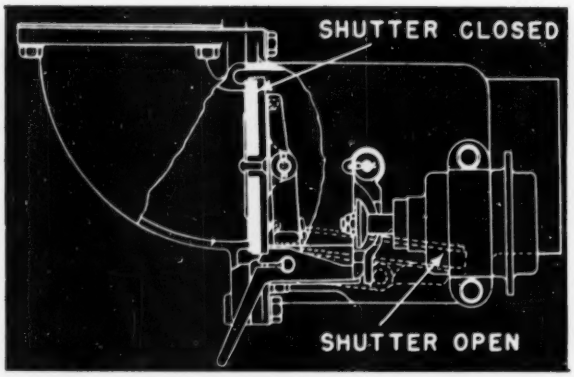


Fig. 9 In bus applications emergency stops are effected by cutting off the supply of air to the engine. A shutter, when tripped, effectively blocks air entrance.

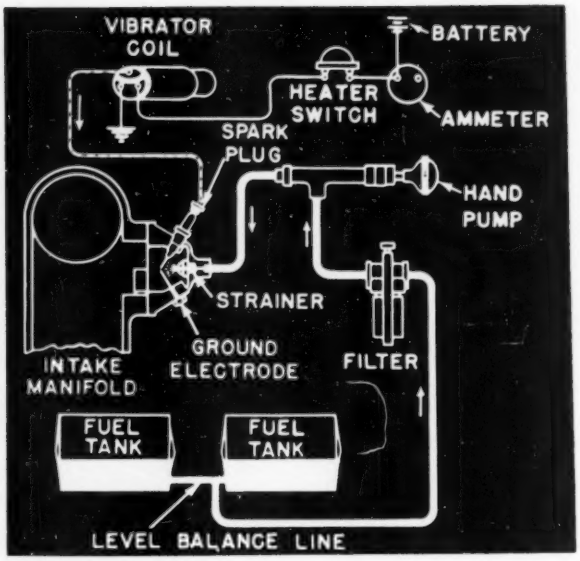


Fig. 10 Schematic diagram of the fuel-burning manifold pre-heater that facilitates cold-weather starting. Scavenging air is directly heated and the manifolding and parts warmed as a secondary source of heat.

The torque controls drops out of action just before the desired speed is reached, because at that moment the centrifugal element begins to expand against the resistance of the speed spring and moves the pilot valve, thus reducing the hydraulic pressure on the servo cylinder so that the torque control piston is pushed back by the spring allowing the cam lever to drop down. This takes place gradually enough to avoid a sharp reduction in fuel feed rate which would otherwise be apt to produce hunting.

In the reverse direction, when the torque control cam lever does drop down, its influence on the floating lever causes the speed spring to be stiffened, thus causing the engine speed to increase slightly under a fixed accelerator, giving the driver a similar awareness of the decrease in the engine loading.

Maximum Speed Control—Maximum speed limitation is accomplished by a simple stop screw which limits the angularity of the accelerator-connected bell-crank, thus limiting the maximum force of the speed spring. A similar stop screw on the opposite sides limits the degree to which the speed spring may be relaxed, thus determining the idling speed. A simple spill valve communicating with the fluid passage from the pilot valve to the servo cylinder is connected with the normal stop control. When this valve is opened, fluid pressure is relieved and the rack is moved to the position of no delivery.

Governor Pump—As the governor operates on the engine's lube oil, it has been found necessary to provide a special oil filter between the supply and the governor to guard against possible gumming of the pilot valve should the operator neglect the main lube oil filter or periodic oil changes. Since the volume of oil used by the governor is small and the supply is prefiltered by the main lube oil filter, this special filter requires infrequent servicing.

Accessory Equipment

Connection of the accelerator to the governor speed control on trucks is purely mechanical with only rods and levers employed. With rear engined buses, however, a remote control system is necessary due to the distances involved, and this may be either a hydraulic or air servo system.

For normal stop control, the governor is equipped with a means of completely stopping the fuel supply.

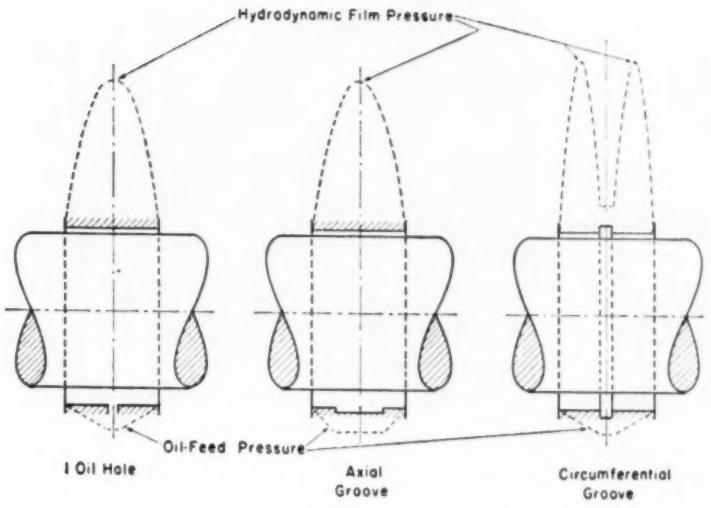
For emergency stop control, two entirely different systems are used. A simple shut-off cock on the primary fuel feed line, actuated by a Bowden wire from the instrument panel, is used on trucks. This is shown in Fig. 8. In bus engines, the emergency stop is effected by a clapper valve in the intake manifold, held open by a detent against a lever spring, which can be released by a solenoid controlled by the driver. This is shown in Fig. 9.

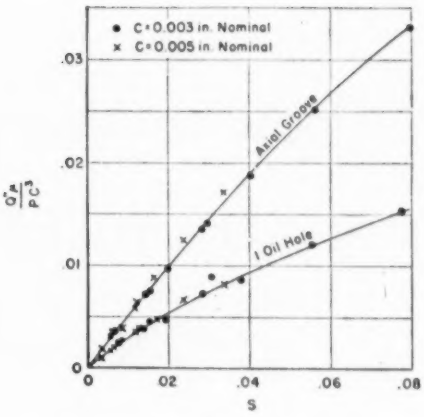
For cold weather starting or after the engine has cooled to below freezing, a manifold air pre-heated is provided. This consists of a simple spray nozzle and igniter whereby a jet of flame is created inside the manifold so that not only the air but the metal as well is pre-heated. It utilizes fuel drawn from the main supply and forced to the nozzle by a hand operated plunger pump. Diagram of the heater is given in Fig. 10.

In one other respect, the control system employed in buses is somewhat more complicated than in trucks; in that, for safety reasons there is a duplicate control panel within the engine compartment, thus enabling the mechanic to start and stop the engine, trip the emergency stop control and regulate the speed control on the governor directly by hand without entering the bus.

Service Adjustments

Service adjustments in this control system are simple and few. In the governor there are but three, namely the high-speed limit stop and the idle speed adjustment on the speed control lever, and the speed droop adjustment on the torque control cam lever. All three are simple stop screws with check nuts and permit the setting of the maximum speed, the idle speed and the sensitivity of the speed droop. The latter is used chiefly to eliminate unsteadiness either in idling or running.





At left, pressure distributions for each design of oil feed are shown. Above is a plot of parameter containing Q″ versus Sommerfeld number. Similar plot is shown below with Q′ parameter versus the reciprocal Sommerfeld number.

Oil Flow in Plain Journal Bearings

Engineers in the bearing industry are faced with this current problem. Much still remains to be done, especially on combinations of laminar and turbulent flow combined with aeration; however, it is heartening to see that work on the general problem is under way. Here is a brief description of work carried on by the National Bureau of Standards in conjunction with the National Advisory Committee on Aeronautics.

A SIMPLIFIED method of analysis for the rate of oil flow in plain journal bearings has been developed by S. A. McKee, head of the National Bureau of Standards engines and lubrication laboratory. This problem is important to bearing design and operation as an adequate oil flow is essential to insure not only the maintenance of a load-carrying oil film, but also the disposal of frictional heat developed in the bearing.

The new method developed from data obtained on the NBS four-bearing friction machine in conjunction with the NBS-NACA lubrication research program, indicates that flow of oil from the ends of plain journal bearings fed through an oil hole, an axial groove on the unloaded side, or a circumferential groove may be affected by two factors. One results from the oil-feed pressure, and the other from the hydrodynamic-film pressure supporting the load. In the case of a bearing with a circumferential groove, the flow due to the hydrodynamic-film pressure is negligible in comparison with that due to the oil-feed pressure. For the other two types of bearings, however, both causes produce appreciable flow.

In the present work, analytical simplicity is achieved by postulating that the rate of oil flow, Q, is made up of two components, as follows:

$$Q = Q' + Q'' \qquad (1)$$

where Q′ is the flow rate caused by the oil-feed pressure and Q″ is the flow rate produced by the hydrodynamic-film pressure supporting the load. It is further recognized that, for any given type of oil-feed design, the two oil-flow components are related to bearing dimensions and operating variables. This relationship may be expressed by the following dimensionless equations:

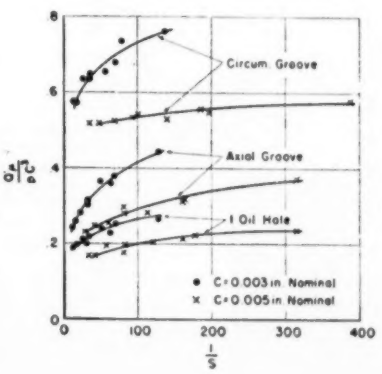
$$\frac{Q'\nu}{pC^3} = K_1\left(\frac{D}{C}, \frac{C}{L}, \frac{\nu N}{P}\right) \qquad (2)$$

$$\frac{Q''\nu}{PC^4} = K_2\left(\frac{D}{C}, \frac{C}{L}, \frac{\nu N}{P}\right) \qquad (3)$$

where ν = absolute viscosity of the lubricant at atmospheric pressure and bearing temperature; p = oil-feed pressure, P = load per unit projected bearing area, N = speed of journal, D = journal diameter, L = bearing length, and C = diametral bearing clearance.

As indicated above, the functions K_1 and K_2 depend upon the oil-feed design of the bearing. These have been determined experimentally for three basic designs: (1) one oil hole on the unloaded side of the bearing, (2) an axial groove on the unloaded side of the bearing, and (3) a circumferential groove. The results may be shown graphically by plotting the parameter containing Q″ against the Sommerfeld number, $S = (\nu N/P)(D/C)^2$, and by

(Continued on page 135)



How to Warm Up Your Diesel

*by Charles B. Graves**

Is your diesel equipment being sent to the scrap pile before its time by cold starting abuse? Check your starting procedure here.

THERE has been much discussion and written material about the country as to why some diesel engines are hale and hearty after years of service, while others are sputtering around and in generally pretty bad shape before they much more than have the paint burned off the exhaust pipe. Keeping troublesome jobs running requires plenty of parts, labor, and capital—to say nothing of losing use of the equipment during the downtime. Why this difference?

Of the many and varied answers to this question, just about everything from the fan belt to the flywheel has been held responsible, but seldom is any mention made as to how well the engine has been operated and maintained.

Furthermore, some outfits are especially proud of the "excellent" time their drivers make over the road. Little thought do they ever give as to how he got there, or to what speed their equipment was subjected during the run.

To this end "tattle-tale" clocks have been introduced. Although they tell the boss just about everything except how many cups of coffee the driver had during the trip, they do not give any information as to how the engine was treated.

Cold Starts

One of the most damaging practices in the operation of any diesel—and this goes for gasoline too—is starting up a cold engine, then racing it a couple of times, putting it in gear, and taking off with a full load. How many times have we all seen this done? Outside of driving over the side of the Grand Canyon, this is the fastest way to wreck a job.

The greatest wear occurs in starting a cold engine because the oil has not had a chance to circulate throughout the engine. It is a pure metal-to-metal proposition. This is why it is so important to let the engine idle awhile before the load is applied, as the load greatly increases the forces exerted on pistons, cylinder walls and bearings.

A word here on idling speeds. A fast idle is recommended so as to insure an oil supply to parts that depend upon splash oil for lubrication. Too slow an idle does not insure this.

Circulation of oil is only part of the warm-up story. Equally important is the fact that excessive thermal stresses are avoided with a slow warm-up. Some parts such as cylinder heads, piston crown and upper part of the liners get hot rapidly and therefore expand almost immediately. Other parts of the engine remain cold. These great temperature differences cause thermal stresses that will warp the engine out of line. This will naturally cause the crankshaft to turn against high friction loading. With a proper warm-up these loads caused by thermal stresses are less harmful, but if a load is applied, as is often done, it only adds to the distortion.

Now the question is, why aren't all drivers or mechanics on the job instructed to perform this important operation? Two common replies are:

First the engine had to pull the grade. Unless thoroughly warmed a lot of damage was done. On the down-grade it's going to cool off and may be over-speeded.

*Instructor, Diesel Engines, Laney Trade and Technical Institute, Oakland, California.

1. Many operators claim that it costs money to warm up the engine when it can be done going down the highway.

2. It will involve over-time for the mechanic to turn to a half-hour early and have the equipment up to temperature when the work starts.

The result of many years of experience indicates that this is the cheapest service that can be bought today.

On automotive type engines, experience has indicated that at least a half-hour should be taken for the warm-up period. Some owners that are aware of the advantage of engine warm-up take only fifteen minutes. While this is usually sufficient with a gasoline engine it isn't for a diesel. The average diesel usually weighs more than a comparable gasoline job and the extra time is required for the heat to become evenly distributed throughout the engine.

On some jobs where the engine is not required to run steadily all day long, the engine should not be allowed to become cold, but should be kept running throughout the day.

The writer will challenge any equipment owner to try this for at least six months to see what a difference it will make in breakdowns and repair bills. Furthermore, the engines will be easier to start and smoother running. As would be expected, battery life will be increased, but more than this, a decrease of about 75 per cent in all around maintenance has been indicated. These savings in maintenance alone will more than pay for an extra mechanic to start all engines a half-hour before the crew arrives.

The writer is acquainted with equipment owners who warm up their machines a half-hour or more and are saving money they never thought possible. At the same time no competitor has been able to catch up with them in prices or running time.

Hot Stops

This discussion has so far dealt with the proper warming up of cold engines and preparing them for work. It is equally important that the engine be properly shut-down. This phase of engine care is seldom if ever given any thought.

Both types of service are tough and warm-up is important. The shovel engine operates at fairly constant speed; the truck engine can be "lugged" and over-speeded. Correct operation is, therefore, very important to engine life.

When stopping an engine that is up to proper operating temperature, the engine should be throttled down to an idle for a sufficient period to allow the engine parts to cool slowly and evenly while the cooling water is circulating. By so doing, undue stresses on various engine parts and "after-boiling" of the water will be avoided. A 5-min. cooling-off period is generally held sufficient for automotive-type engines.

In one particular case an epidemic of cracked cylinder heads was cured by a short idling period before stopping the engine.

Do You Need Trained Diesel Men ?

A card to DIESEL POWER AND DIESEL TRANSPORTATION will bring you our listing.

Over-Speeding

Now, just to keep the record straight, it is not in any way intended that these ideas will stop the burning of piston ring belts, cylinder heads, injector tips and valves, which is caused by "barrelling" down the highway.

When an engine throttle is wide open, an excessive amount of fuel is sometimes injected into the combustion chamber resulting in temperatures sufficiently high to burn these parts so thoroughly that portions of them are completely disintegrated. On one particular day that the writer recalls, twelve large diesel trucks came into the shop in this condition.

The best way to stop such destruction of engines is to slow down to state highway speed and save your engines. Over-travel of the racks is provided to give excess fuel for more torque but is not intended for continuous high-speed operation.

Another way that use of this excess power is abused is for long periods of "lugging". This is what the gear shift is for, so use it. One of the major things needed in limiting the amount of fuel is a tamper-proof governor; fooling with these can only lead to trouble and expense.

If some of these very basic things about proper operation of diesel trucks could be driven home, the owners would begin to realize the full economic advantages of diesel power.

Straight from the Tool Box
This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Repairing a Crankpin the Hard Way

J. Quiros L., Costa Rica—Herewith, I give details of a problem I came up against with an Ingersoll-Rand diesel engine of 377 hp. at 616 rpm. It is used to drive a centrifugal pump for irrigation purposes.

As the result of an accident the babbitt was displaced in the No. 4 connecting rod steel-backed shells. The crankpin was so badly worn in the thrust area that the repair created a problem of the first order. It was necessary that a repair be made without removal of the crankshaft for rectification and with the least loss of time.

The crankpin was worn to the extent of 0.33 in. out of round. The only way that it was possible to rectify it was by hand filing. It took eight days of filing to get it within 0.007 in. of being true. This proved to be tedious work inside the crankcase. *(Amen—Ed.)*

Lapping blocks were then made and they were rotated by means of ropes extending through to each side of the engine. The pin was finally lapped to 0.001 in. of being round. Bronze shells from the U. S. were fitted and the engine has now operated about 4000 hr. without any trouble.

We found that bronze shells require about 0.003 in. more clearance for this engine than did the babbitted shells.

(The object in selecting this item was not to encourage the practice of hand filing crankpins, but to show what can be done when you have to do it. We know of a few similar instances in this country. We'll bet that our correspondent wishes that he had the handy tool used by Washington Iron Works, Texas, for finishing crankpins in place. We are at a loss as to whether the new bearings were bronze-backed babbitt-lined shells or perhaps copper-lead bearings. Perhaps we'll hear later—Editor)

Trouble Shooting Check List

John A. Willett, California—Following is a Check List that has been my "bible" in trouble shooting:

1. Failure to Start

Electrical—Batteries run down; control circuit open; starter defective; generator cut-out circuit open; cranking speed too low.

Mechanical—No fuel oil; fuel system airbound; emergency shut-off valve closed; compression low; defective nozzles.

2. Overheating

Insufficient water; engine overloaded; fouled radiator, internally and/or externally; fans not operating properly; excessive water jacket deposits; water circulating pumps defective; radiator shutters improperly adjusted.

3. High Lube Oil Consumption

Improper lube oil; worn liners and pistons; stuck piston rings and/or plugged oil rings; leakage; excessive splash on liner walls (excessive throw-off from worn bearings or too-thin oil); high crankcase temperatures.

4. Sudden Stoppage

No fuel; safety shut-down functioning (from high temperatures of water and/or lube oil, over-speed, low oil pressure, etc., depending on type); mechanical failure.

5. Intermittent Firing

Water or air in fuel lines; compression at critical point.

6. Weak Cylinders

Compression low (due to blow-by and/or leaky valves); injection nozzles defective; fuel timing out of adjustment.

7. Excessive Crankcase Dilution

Incomplete combustion (could be low compression, excessive fuel delivery, faulty injection system giving poor atomization); poor crankcase ventilation; late fuel timing; leaks.

8. Knock

Overload; improper fuel (cetane number too low); faulty fuel spray patterns; improper timing of injection.

9. Excessive Smoking

Operational—Overloading; excessive idling; over-cooling.

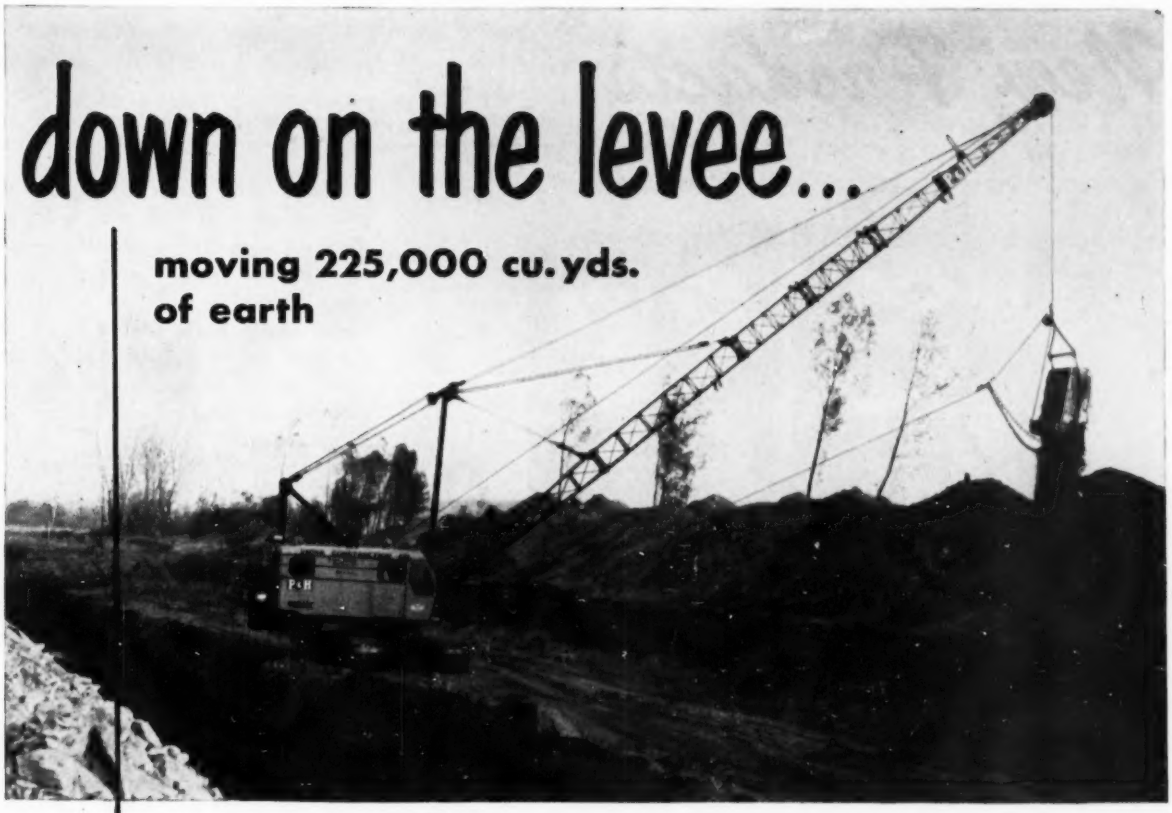
Incomplete combustion—Incorrect air/fuel ratio (plugged air filter); excessive fuel; incorrect timing; faulty injection system; wrong grade of fuel; low compression.

Lube in Combustion Chamber—Cracked or broken pistons; excessive liner and piston wear; faulty piston rings; insufficient crankcase ventilation.

(Pretty good and fairly complete check list. This fellow is no "parts changer"; he wants to know "why".—Editor)

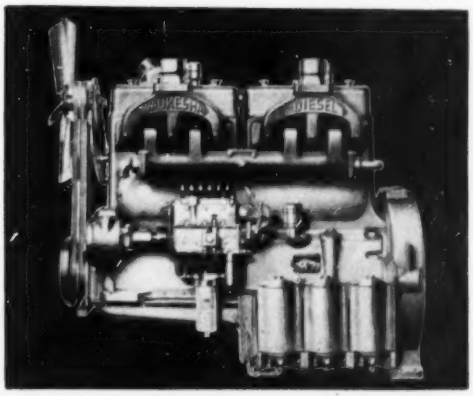
down on the levee...

moving 225,000 cu. yds. of earth



casting up to 300 yds. per hr. THIS P&H DRAGLINE HAS A WAUKESHA Diesel

● Silt, gumbo and muck! And 225,000 cu. yds. of it had to be moved—for a revetment on the Missouri River. The Usona Construction Co. of St. Louis, Mo., lost no time in doing it. Their Waukesha Diesel powered 3-yd. P & H dragline stayed right with the job—20 hours a day, 5 days a week. Cave-ins were frequent; there was a lot of under-water digging—but the Waukesha Diesel kept on putting out the power, and the P & H averaged 200 cu. yds. an hour, sometimes casting as high as 300 cu. yds. One good job deserves another—now this dragline is speeding up a levee job on the Mississippi River. As shown here on the Missouri job, with a 90-ft. boom and 3-yd. bucket, like all P & H 955-A draglines and shovels it has the 6-WAKD Waukesha Diesel, the engine noted for its snappy, *fast recovery.* That means more loads per minute! For its many unusual performance features—get Bulletin 1415. 170



Model 6-WAKD Super-Duty Diesel—six cylinders, 6¼-in. bore x 6½-in. stroke, 1197 cu. in. displacement.

WAUKESHA MOTOR COMPANY • WAUKESHA, WIS.

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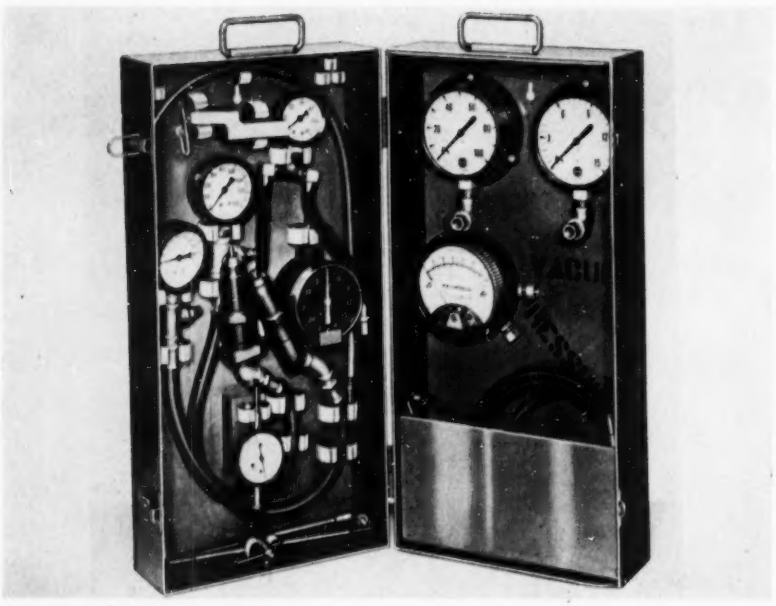
New Products



New Test Kit Speeds Trouble Diagnosis and "P.M." Checks

A new basic diagnosis test kit, designed to aid the mechanic when diagnosing trouble or making preventative maintenance checks on GM diesel engines is announced by Kent-Moore Organization, Inc., General Motors Bldg., Detroit 2, Michigan.

The kit, No. J 4209-41, includes all equipment required for checking timing, exhaust back pressure, engine rpm., blower intake restriction, air box, oil, crankcase pressure, plus cylinder liner position on all Series 71 and 6-110 GM diesel engines. Also available are tool Nos. J 1319-A and J 4494, compression gauges for the series 71 and 6-110 respectively, and a fuel pressure gauge for both series (KMO 320).

All equipment needed for field or service department testing is mounted in a metal box. It includes: 0-15 lb. and 0-100 lb. U. S. pressure gauges, magnehelic gauge, 0-3600 rpm. tachometer with flexible extension and adapters, plus dial indicator with attachments, and cylinder liner gauge block.

British Machine Tool for Injector Maintenance

For the complete servicing of injector needles and nozzle seats, the Merlin Engineering Company, Ltd., Hebble Mills, Salterhebble, Halifax, England, have designed and manufactured a machine known as the "Service Master". Although this has been marketed for a comparatively short time the concern claims that it has been approved and is used by fuel injection equipment manufacturers and some government departments.

The machine is designed to deal with all types of lap used in the rectification of fuel-injection equipment, and provision has been made to vary the seating angles between 52 deg. and 68 deg. It can deal also with all types and sizes of needle normally encountered. If special fittings are required to handle certain American equipment, the concern will cooperate to supply what is necessary.

The "Service Master" is a small-capacity centerless grinder of heavy construction in relation to its work, the main ½-hp. motor driving a 4-in. grinding wheel at 4000 rpm. and also driving a work-driving spindle through an infinitely variable gear giving a range of 80-120 rpm. An additional ½-hp. motor has a Jacobs chuck at one end and a lapping disc at the other. It can be set horizontally or vertically, or reversed end for end on its mounting.

This new machine can deal with a large quantity of work per hour by means of the wheel head, and will simultaneously permit a second operator to be lapping in seatings with laps or needles, or sizing or polishing needles where selective assembly is employed.

Silencing Equipment for Intake of Air Compressors

Burgess-Manning Company, Libertyville, Illinois, has recently developed equipment which it is claimed will reduce air-borne air compressor intake noise. Three snubber series have been designed which also will meet pulsation problems.

The silencing equipment has been prepared to apply to any type and size of compressor and to meet all needs of silencing requirements, ranging from non-critical industrial locations to highly critical applications such as residential areas, etc.

Recommendations for the application of these snubber series are made by company engineers after considering the make and model of the compressor, bore and stroke, whether double or single acting, number of cylinder, rpm. and a description of silencing requirements.

New Line of Oils, Greases, Waxes

The M. W. Kellog Company, P. O. Box 469, Jersey City 3, N. J., announces a new line of greases, oils and waxes.

These new products are said to have excellent high temperature properties as well as high electrical resistance.

They are chemically inert and, it is claimed, can withstand virtually any corrosive.

Kel-F oils have lubricating properties which are useful in applications where chemical inertness and resistance to high temperatures are important. For electrical uses, the oils are a logical specification for cable and transformer applications where heat resistance and excellent dielectric properties are both essential.

The chemical inertness may be valuable in solvents and in providing a sealing medium for instruments. The greases have indicated possibilities for stop-cock and plug-cock applications where inertness is a basic requirement, and the waxes, as sealing mediums in certain potting, closure or covering uses.

New Rotary Pump

A new rotary IMO pump, A313B, has been announced by De Laval Steam Turbine Company, Trenton 2, New Jersey. This is a general service screw-type rotary pump designed for handling petroleum products and other light viscous fluids as required for hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services. Capacities are to 80 gpm., pressure to 275 psi. (continuous) and to 325 psi. (intermittent).

The main features of the pump include: pulsation free flow, mechanical shaft seals, pre-lubricated bearings, and optional types of mountings. It can be mounted in any position and be driven by direct connected shaft, V-belts or chains.

New Volt-Ammeter

Pyramid Instrument Corporation, Lynbrook, New York, announces the latest model to be added to the line of Amprobe snap-around volt-ammeters —the Amprobe 600. It combines the six ammeter ranges and three voltmeter ranges in one pocket-size instrument: 0-15/30/60/150/300/600 amps ac., and 0-150/300/600 volts ac. It measures current instantly without need of interrupting the circuit or shutting down equipment.

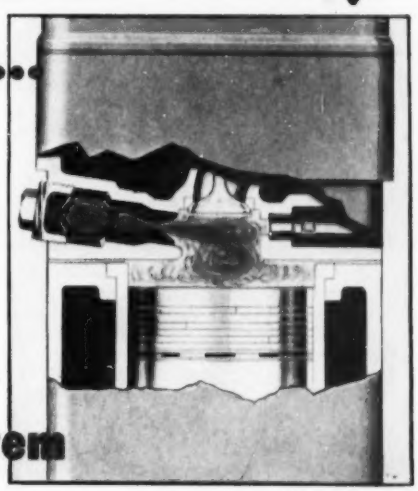
Design features incorporated are: doughnut-type transformer said to eliminate for all practical purposes the factor of error due to position of conductor within probe jaws; 9-range fingertip selection; voltage test lead plug, automatically insulated by snap-out sleeve when removed from meter; probe jaws completely insulated high-visibility, no-rim window; and the instrument is pocket-sized, belt-mounting. Price is $59.50, which includes leather case and voltage test leads.

New Tachometer

The Boulin Instrument Corporation, 65 Madison Avenue, New York 16, N. Y., has available a new tachometer.

This instrument has four major features: a stop button locks the indicating hand at the point of measured indication for precise reading; easily operated and positive acting range selector permits quick change to desired range; only one uniformly graduated scale; and a wide range, 50-50,000 rpm., suitable for all practical industrial speeds.

Operating Economy starts here... in the LANOVA combustion system



If you're looking for a way to save money on fuel bills, check into the economies offered by Diesels that use the Lanova Combustion System.

The Lanova System is designed to utilize the maximum amount of the fuel's energy in the production of useful power. It does this, first, by setting up a violent turbulence in the cylinder which thoroughly mixes the fuel with the air needed to support combustion, Then it times and controls combustion pressures so that they are applied over a longer period of the power stroke. The result — greater operating economy — more profitable power production.

MOST LEADING MAKES of Diesels use the Lanova Combustion chamber principle. But be sure of getting what you want — always look for the distinctive Lanova energy cell design.

LANOVA CORPORATION
38-18 30th Street
Long Island City 1, N. Y.

ONE OF AMERICA'S FOREMOST NAMES IN DIESEL RESEARCH AND DEVELOPMENT

ALL TYPES OF JOHNSON BEARINGS

You name the use . . . . we'll furnish the Bearing

Regardless whether you need heavy main bearings, connecting rod bearings, piston pin bushings, or valve guide bushings, your best source of supply is **JOHNSON BRONZE.** No other bearing manufacturer can furnish every type. Johnson Sleeve Bearings include babbitt-on-bronze, cast bronze, aluminum alloy, bronze-on-steel, sheet bronze, babbitt-on-steel, graphited bronze, and Ledaloyl self-lubricating. Years of experience working with diesel manufacturers enable Johnson engineers to study conditions and impartially recommend the correct sleeve bearing for the application. Write, wire or call for an appointment.

JOHNSON BRONZE CO.,
470 So. Mill St., New Castle, Pa.

JOHNSON BRONZE is equipped to produce sleeve bearings for any type of diesel engine.

SLEEVE BEARING HEADQUARTERS SINCE 1901

JOHNSON B BEARINGS
Sleeve-Type

New Machine for Precision Cleaning

Zenith Manufacturing and Chemical Corporation, 52 Beekman Street, New York 38, N. Y., announces a new cleaning machine for all industrial uses. The machine has been designed specifically for cleaning every kind of instrument with small or large delicate parts.

"Instro-Met" has the following features: Three clear-view windows on motor support for checking while in operation; Spun aluminum tanks and covers; Heavy cast aluminum basket with 7 3/16 in. ID; 3¾ deep. Basket has three monel mesh removable compartments for cleaning a variety of different parts simultaneously; Snap-on operation of basket to impeller shaft eliminates hazard of accidental loosening; Overall size, 23¼ by 26¼ in., 26-in. high.

Other features are the 14-to-1 gear reduction, ball bearing motor—ac.-dc. —with reversing action; motor-driven unit; heavy cast aluminum base. The weight of the basket and parts is supported by ball and needle bearings, said to take all "thrust" off the motor.

Price of "Instro-Met" is $279.50.

New Chemical Destroys Rust and Phosphatizes Metals

A new chemical treatment that removes rust, tarnish and light oil, and chemically prepares metals for paint, and retards corrosion, is announced by Octagon Process Inc., 15 Bank St., Staten Island 1, N. Y. Known as "Rustclean", it not only chemically cleans the surface of steel, iron, alu-

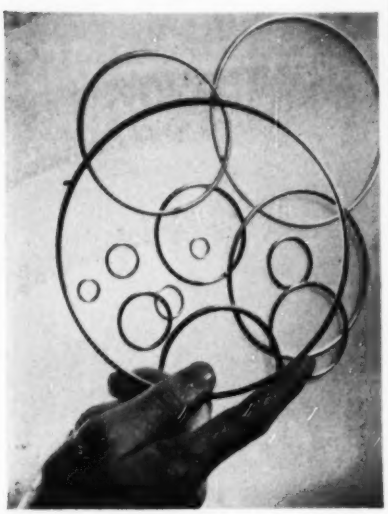
minum, zinc and cadmium, it also forms a phosphate coating which acts as a base for organic finishes. It is also an effective tarnish remover for copper and its alloys.

Besides applications in the metal fabricating field, it is useful in the maintenance of storage tanks, machinery, petroleum equipment and pipelines. Several types of the product are available, each designed for different work.

It contains a mild acid which offers very little hazard to personnel and hasn't the corrosive action of strong pickling compounds such as sulfuric, nitric and hydrochloric acids. It doesn't fume, or emit toxic vapors and can be used in the same area where steel is finished or stored.

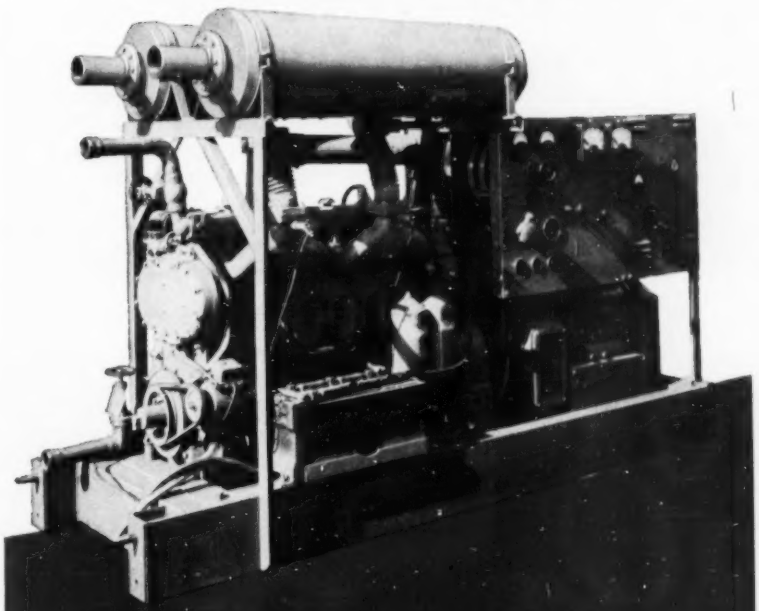
Pressure Filled Metallic O-Rings For Static Seals

United Aircraft Products, Inc., 1160 Bolander Ave., Dayton, Ohio, have announced a new metallic O-ring—a permanent, hollow metal tubing ring filled with inert gas at 600 psi. They offer positive metal to metal static seals wherever problems of heat, pressure, corrosive liquids or gases are involved. They are dimensionally stable under heat or cold, are not affected by age, and are impervious to oils, gases or aromatic mixtures, it is claimed.



These rings can be installed in present ring grooves, in free machined recesses, or with a special compression limiting device which can be in-

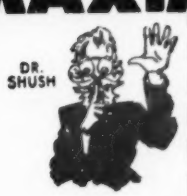
MAXIM SILENCERS*



GOOD PUBLIC RELATIONS FOR PORTABLE POWER ANYWHERE

* Twe Maxim Exhaust Silencers shown on General Motors Diesel generator set built for portable power for "on location" movie making.

Consult MAXIM



THE MAXIM SILENCER COMPANY
93 Homestead Ave., Hartford 1, Conn. Dept. W.L.

Gentlemen:
Please send me your bulletin on Exhaust Silencer.

Name _____

Company _____

Address _____

_____

corporated in the rings, can be installed without grooves or recesses. It is claimed that they will hold against pressures as high as 20,000 psi. and withstand temperatures limited only by the "physicals" of the metal.

These metallic O-rings were invented in England, and have been in use in the United Kingdom for several years in such applications as high compression diesel engines, all types fuel and exhaust systems, retractable undercarriages and other hydraulic applications.

Standard rings of stainless steel or of mild steel cadmium or nickel plated are available now in experimental quantities in sizes ranging from 11/16- to 40-in. OD in increments of 1/16-in. Production equipment installations now going on at UAP will make the rings generally available in the near future.

5-lb. Dry Chemical Fire Extinguisher

A new, pressure-operated, dry chemical portable fire extinguisher has been announced by Walter Kidde & Company, Inc. The unit answers the need for a small, dry chemical unit which can be recharged easily in the field.

The design of the portable permits it to be serviced following discharge by simply pouring 5 lbs. of dry chemical into the powder chamber and, with the aid of a gas station or factory air line, charging the unit with 150 lbs. of compressed air.

The nozzle discharges a cloud-like pattern which is effective for extinguishing flammable liquid and electrical fires. With a range of 5-7 ft., the cloud pattern also eliminates the possibility of splashing burning substances as a result of too forceful a discharge stream.

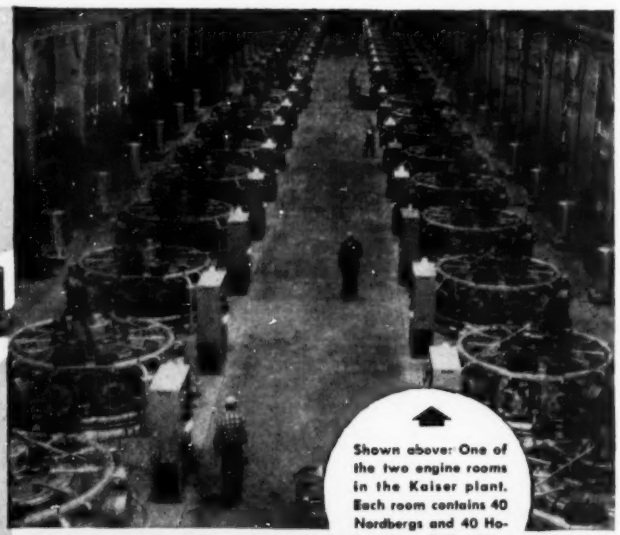
Built into the extinguisher's handle is a gauge, which shows the exact pressure carried by the extinguisher.

Honan-Crane

Oil Purification

...first choice to protect all 80 Nordberg Diesels at Kaiser Aluminum's huge new Chalmette Plant

In the giant Kaiser Aluminum and Chemical Corp. plant 80 Honan-Crane Oil Purifiers maintain a continuous supply of clean, safe cylinder and crankcase oil for 80 eleven-cylinder, 1820 HP Nordberg gas engines. Again, experienced diesel engineers have specified *Honan-Crane* for safe, dependable protection against breakdown and excessive wear due to contaminated oil! Honan-Crane Oil Purification (for either inhibited or straight mineral oils) protects bearings, cylinder walls and other finely machined parts from improper lubrication and costly damage often caused by solid abrasive contaminants or by acids, gums, resins and other products of oxidation. Write today for complete information about Honan-Crane Fuel and Lube Oil Purifiers.



Shown above: One of the two engine rooms in the Kaiser plant. Each room contains 40 Nordbergs and 40 Honan-Crane Oil Purifiers.

WORLD LEADING OIL FILTER MANUFACTURER

Honan-Crane Corp.

305 Wabash Ave., Lebanon, Indiana

A Subsidiary of

Houdaille-Hershey Corporation

Should the gauge fall below 150, additional pressure can be added to bring it up to the unit's designed operating pressure. Weight fully loaded is 10 lbs.

New Air Cylinders

A new line of air cylinders, comprising 28 different models, each in 9 bore diameters, is now being offered by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

The new air cylinder follows the design of the company's hydraulic cylinder by using keeper rings to hold covers together instead of the conventional tie rods. This feature permits covers to be rotated to convenient pipe locations and the cylinder applied in a minimum of space.

Recommended for pressures up to 150 psi., the cylinders are available in 7 mounting styles, in any length of stroke up to 96-in., single or double-end rods, with internal or external thread, and cushioned rod end, blind end, or both.

New Chrome Plating Unit

A 250-ampere unit has been added recently to the Ward Leonard Electric Company's new line of industrial

chrome plating equipment. This new production tool is designed for industrial chrome plating small tools or parts in large quantities, or generous size parts with areas to 125 sq. in. It is claimed that with "chromaster" and "chromasol", the new chrome plating solution, normal life of cutting tools, wear parts and dies can be increased up to ten times. Average plat-

Standardaire

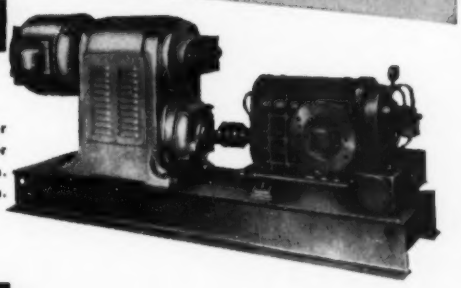
AXIAL FLOW POSITIVE PRESSURE

BLOWERS

provide air to the specific needs of many important industries because Standardaire Blowers are unique in design and construction—unequalled in quality and performance.

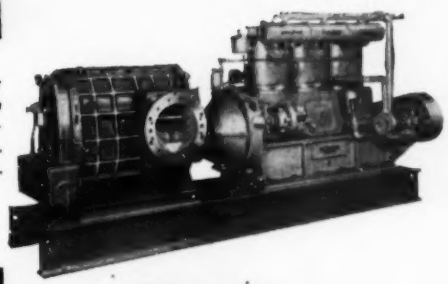
for CHEMICAL PROCESSING

Standardaire Blower with Veridrive Motor to deliver 780 c. f. m. at 1750 r. p. m.



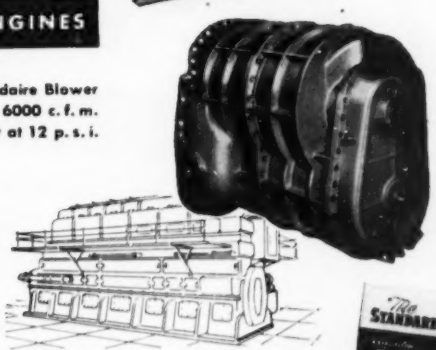
for SEWAGE PLANTS

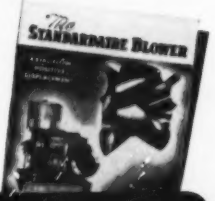
Standardaire Blower with Climax Engine using sewage gas—to deliver 2100 c. f. m. at 720 r. p. m.



for DIESEL ENGINES

Standardaire Blower with 6000 c. f. m. capacity at 12 p. s. i.





AXIAL FLOW STANDARDAIRE BLOWER

Write DEPT. F-28 for Publication No. 90

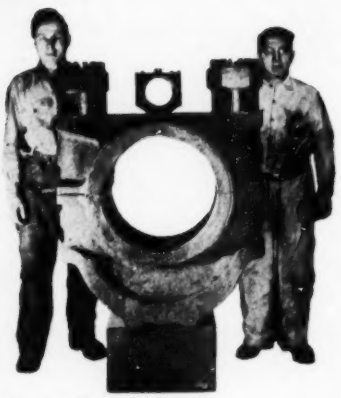
BLOWER-STOKER DIVISION

READ STANDARD CORPORATION

370 LEXINGTON AVE., NEW YORK 17, N.Y.

DIESEL SPECIALISTS

CENTRIFUGAL REBABBITTING



Bearings of all sizes from light weight high speed diesels to large low speed direct drive diesels . . . rebabbitted on specialized GOLTEN apparatus.*

REPAIR AND SERVICE on Woodward Governors, all types of fuel injection equipment and centrifuges.

FULLY EQUIPPED SHOPS for repairs and manufacture of parts, for pipe bending and coppersmith work; large stock of spare parts on hand.

*Patents Pending

DAY & NITE SERVICE ULster 5-7200

SIGURD GOLTEN MACHINE CORPORATION
455 CARROLL ST., B'KLYN 15, N. Y.

Affiliated Companies
HYDRAULIC HOIST CORP., Renton, Washington
ATLANTIC DIESEL A/S, Oslo, Norway
NORLANTIC DIESEL, INC., New Bedford, Mass.

LEADING DIESEL ENGINES HAVE *Manzel* FORCE FEED LUBRICATORS

A Fulton type KS Diesel equipped with Manzel Model 94 Lubricator

...THEY CORRECTLY LUBRICATE EACH POINT

Manzel Lubricators supply the *exact* amount of oil needed at each wearing point, reducing oil consumption as much as 90%.

They are furnished as standard equipment on leading makes of engines, and machinery. Or they can be installed on your present equipment.

We will gladly have a Manzel lubricator engineer submit recommendations without obligation. Just write...

Why it Pays to Select Manzel Lubricators

- THEY LENGTHEN THE LIFE OF MACHINERY
- THEY ARE AUTOMATIC AND TROUBLE-FREE
- THEY ELIMINATE "DOWN TIME"
- THEY CUT OIL CONSUMPTION UP TO 90%

Manzel 271 BABCOCK STREET
BUFFALO, NEW YORK

ing time is 3½ minutes for cutting tools.

Individual floor-mounted plating tank and power unit are designed to minimize installation costs and to conserve plant floor space. Power unit contains a built-in selenium rectifier complete with instrument panel and controls for regulating the rate of chrome deposit.

Contact the manufacturer at Mount Vernon, New York.

Improved Locknut

Improvements in their line of locknuts has been announced by The Security Locknut Corporation, North Avenue and 15th Avenue, Melrose Park, Illinois. Better heat treating facilities have made possible improvements in the eliptical retainer ring which is an integral part of this nut, assuring a better lock when the nut is wrenched into position.

This nut consists of a standard steel nut and a slightly eliptical retainer ring combined in a single unit, and when applied can be used simply as a replacement for a standard non-locking type of nut.

Automatic locking of the nut on the bolt does not require bolt tension. When the retainer grips the bolt on which the nut is applied, bolt load or stress is borne entirely by the nut. The retainer portion of the assembly automatically is isolated from bearing contact with the nut and functions solely as a lock to prevent the nut from turning. It is prevented from rotating within the nut by an ear which fits into a cavity machined in the nut body.

Position of the nut on the threaded portion of the bolt or other threaded part can be readjusted at any time. The nut may be removed and reapplied over and over again without losing its locking power and without injury to the threads of the bolt.

New Light-Weight Pneumatic Clay-Digger

A new light-weight Thor pneumatic clay-digger, featuring interchangeable parts to meet every clay digging requirement, has been announced by Independent Pneumatic Tool Company,

175 North State St., Aurora, Illinois.

The new No. 16 digger offers optional inside or outside trigger, closed retainer or latch retainer, choice of five chucks for square, hexagon, or combination hexagon and round shank steels. It weighs 20 lbs., is 19½-in. long and is equipped standard with chuck to take steels with ¾-in. square by 2¾-in. long shanks. Optional chucks take ¾-in. hexagon by 2¾-in. shanks; ⅞-in. hexagon by either 2¾-in. or 3¼-in. long shanks; and combination 0.882 hexagon and 1.027 round by 3¼-in. long shanks. Accessories available in these shank styles include clay spades or scoops, flat picks, saw tooth chisels, moil points, narrow chisels and chisel blanks.

Packaged, Automatic CO_2 Extinguishers

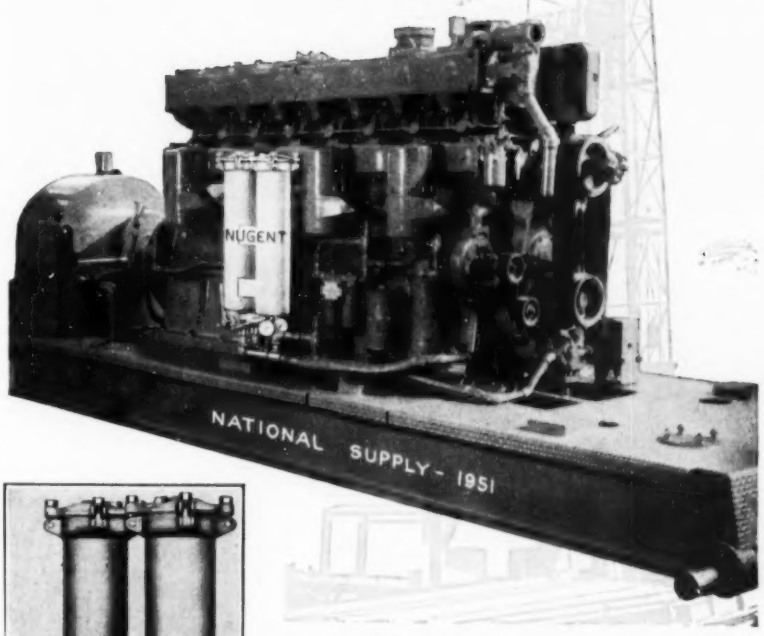
Walter Kidde & Company, 40 East 34 St., New York 16, N. Y., is offering a packaged, automatic carbon dioxide fire extinguishing system. Designed and manufactured to protect normal industrial types of flammable liquid hazards of up to 6000 cu. ft., the new system may be adapted for protection against some special hazards. However, installations may have to be custom engineered for areas where carbon-dioxide, hydrogen, carbon disulphide, butane, propane, etc. are stored.

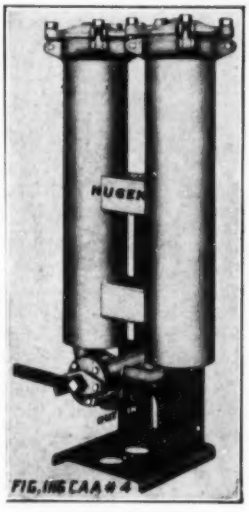
Each package contains temperature-rate-of-rise fire detectors and connector tubing, automatic control heads, discharge heads, multijet nozzles, and a cylinder-supporting frame. As it is impossible to know in advance just what accessory equipment any customer will require, they are not included in the basic package, but may be ordered separately. The systems may be ordered with or without pipe and fittings.

Among the accessory items available are remote control pull boxes for manually actuating the system from one or more locations other than at the cylinders, and pressure-operated trips that can be installed to close weight-operated doors and windows automatically when the system discharges, thus excluding oxygen and preventing escape of fire-killing gas.

NUGENT *Full-Flow* FILTERING...

. . . lengthens diesel engine life
. . . increases engine dependability





Illustrated above is one of several National Superior diesel powered drilling rigs for American Arabian Oil Company equipped with Nugent Full Flow Filters of the type shown.

NUGENT Full Flow Filtering of lube oil is the practical way to provide a maximum of lubrication protection for vital engine working parts. With Nugent Full-Flow Filtering *all* the oil being circulated through the engine is filtered every cycle. Dirt, carbon and foreign matter are removed as soon as they get into the oil. No oil by-passes the filter, because it is the foreign matter in by-passed oil that does the damage.

Nugent Full Flow Filters are made in a complete range of sizes for all sizes and makes of diesel engines. They utilize inexpensive replaceable bag-type charges having 20 times the filtering area of other filters of comparable size.

To get maximum dependability and useful life from your diesel engines, you can't afford to be without Nugent Full-Flow Filters. Write for complete information.

NUGENT TRADE MARK

Wm. W. *Nugent* & Co., Inc.

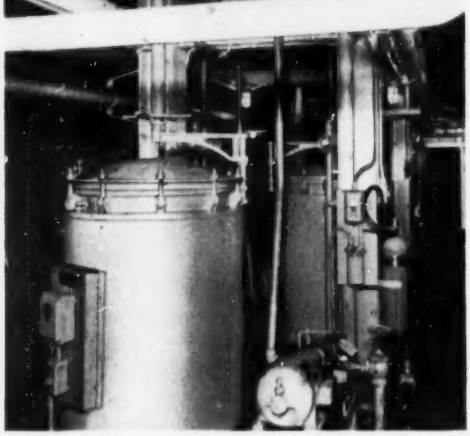
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

ABOARD THE "WORLD'S LARGEST DOUBLE-ENDED FERRY"...



Both engine rooms of the "Vacationland" have two Model I-1118-8E cartridge filters set between two 2360 HP engines. Cartridge replacement is facilitated by cover-lifting device.

HOFFMAN Cover-Lifting CARTRIDGE FILTERS Stand watch over LUBE OIL CLARITY

Plans and specifications for the "Vacationland," recently placed in service by the Michigan State Highway Department, included many special features. For the protection of lube oils used in the four engines, Hoffman Cartridge Filters were selected. Bearings, cylinder walls and other parts are safeguarded against impurities by eight 11 x 18 cartridges arranged in each unit for simple, effective filtration. Swing-bolts and cover-lifting device on each unit speed cartridge replacement.

Engine Builders —Operators

FILTRATION ENGINEERING SERVICE
without obligation — Write for it!

For the right answer to your filtering problem (on new equipment or replacement), consult a Hoffman filtration engineer. He will survey your requirements, furnish recommendations based on a detailed analysis of all factors. Write for it — and for descriptive bulletins.

INDUSTRIAL FILTRATION DIVISION
U.S. HOFFMAN MACHINERY CORPORATION
214 LAMSON STREET, SYRACUSE 6, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Provision can also be made for shutting down ventilation and machinery by inclusion in the system of pressure-operated switches. Alarm gongs and pressure-operated sirens are also available.

Cobalt Radiography Sources for Flaw Detection in Metals

Nineteen cobalt-60 radiography sources, ranging in strength from 50 millicuries to 25 curies, have been developed by Tracerlab, Inc., 130 High Street, Boston, Mass., and are now available for use by foundries, heavy metal fabricators and welding shops.

Cobalt-60 is used for the non-destructive inspection of metal objects for flaws, particularly for the occasional user. Gamma rays emitted have energies of 1.17 and 1.33 million electron volts, which correspond quite closely to the effective energy of a 2 million volt X-ray machine. These energies will permit examination of steel from ½ to 6 in. without excessive exposure times.

Sources are only 21mm. long by 10mm. wide, allowing them to be placed inside complex castings; are made of ferromagnetic stainless steel; have a large threaded hole to accept a remote handling rod; a small hole to allow handling with string; and have flats machined on each side to prevent rolling.

Instrument for Measuring Very Low Pressures

The Dickson Company, 7420 Woodlawn Avenue, Chicago 19, Illinois, announces the development of an exceptionally compact instrument for measuring and recording very low pressures.

Known as the type 3-B minicorder, this instrument is designed for chart records as low as 0- to 10-in. head of water pressure, with other chart ranges available to as high as 0 to 60 psig. (For higher pressures type 3 minicorder is recommended). Overall dimensions are 5¼- by 5¼- by 2¼- in. deep. It weighs only 2 lbs.

The instrument has a "calibration adjustment"—a device that permits range adjustment at any point on the chart, for exact setting. The measuring elements are enclosed in an all

metal case, rubber gasketed for protection from dust, moisture and weather. The entire operating unit is assembled to a heavy lacquered dial, with all parts interchangeable. Pen arm tension and hub caps have been eliminated, for greater ease of operation and maintenance.

It is equipped with a ¼-in. male bottom connection and easily replaces most dial gauges. Measuring elements consist of a series of brass bellows suitable for liquids and gases not corrosive to brass. For certain ranges stainless steel bellows may be specified.

New Light-Weight Ratchet Lowering Lever Jack

A new light-weight ratchet lowering lever jack with an aluminum housing has been announced by Templeton, Kenly & Company, 1022 South Central Avenue, Chicago 44, Illinois. Known as the "Simplex" A1022, the jack is 10 tons in capacity, but weighs only 42 lbs. It is designed to satisfy demands for light weight versatility in a wide range of general purpose industrial, construction, oil field and railroad uses.

The jack has a minimum height of 20½ in., a 12-in. lift and a broad toe lift with a minimum height of 2 in. The toe lifts the full rated capacity of the jack. The A1022 incorporates also such features as drop forged and machined alloy steel operating parts, double-lever sockets, adjustable cadmium-plated springs and links, multiple-toothed pawls, lubricated trunnion bearings and shorter fulcrum centers.

New Lead Lubricant

A new heavy duty grease lubricant, known as "Lead-Lube" has been announced by Knapp Mills, Inc., 23-15 Borden Avenue, Long Island City, N. Y. The significant factor in this lubricant is its extremely high metallic lead content in the form of a pulverized lead dust, kept in permanent suspension.

The function of the metallic lead is to form self-lubricating surfaces over all the wearing parts of gears and bearings, so that the actual surfaces will be protected from wear. In the

send for your copy of this

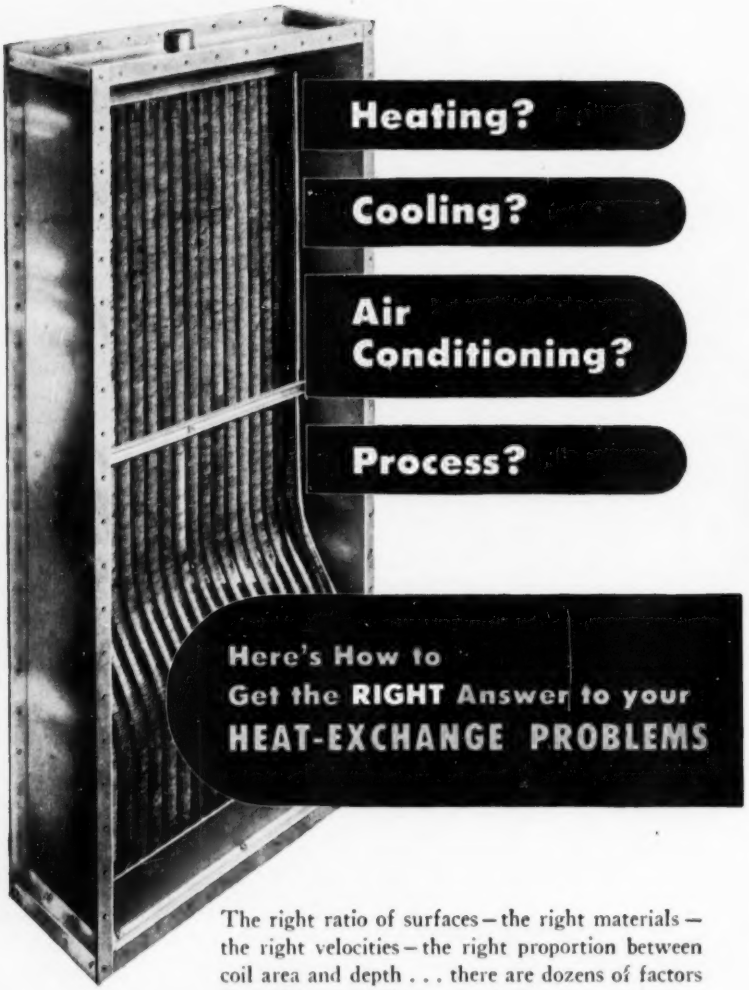
new Snap-on* INDUSTRIAL CATALOG

In this comprehensive catalog is the complete line of Snap-on sockets and wrenches for industrial production. To users of power driven nut runners and impact wrenches, this book offers an instant answer to every socket need . . . every type, every size. Included is a wide range of Snap-on hand tools for assembly operations and plant maintenance. This *edition obsoletes any previous issue* that may be in your files. Write for your copy today.

SNAP-ON TOOLS CORPORATION

8064-D 28th Avenue, Kenosha, Wis

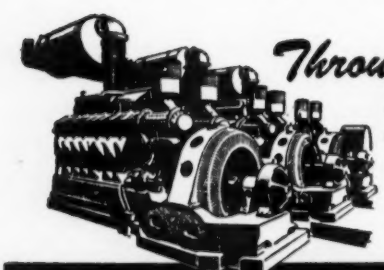
* Snap-on is the trademark of Snap-on Tools Corporation



The right ratio of surfaces—the right materials—the right velocities—the right proportion between coil area and depth . . . there are dozens of factors that affect the efficiency, maintenance and service life of heat-exchange coils.

For best performance in your own application, the practical approach is to take full advantage of the unequalled engineering, research and design skill — the unequalled manufacturing and testing facilities — which Aerofin offers you.

To get the *right* answer—ask the Aerofin man.



Throughout the Power Industry—

Aerofin units do the job Better, Faster, Cheaper

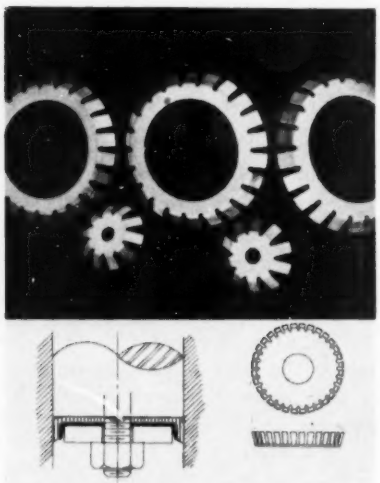
AEROFIN CORPORATION 410 South Geddes St Syracuse 1, N. Y.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

case of older equipment, the metallic lead will re-surface pits and scores, and thus, it is claimed, restore a degree of efficiency comparable to that which existed before wear.

New Cup Expander for Cylinder Packings

HPL Manufacturing Company announced recently the availability of a new line of cup expanders, designated ES-11, which has been developed to eliminate leakage in hydraulic and pneumatic cylinders. The expanders



insure positive sealing action of cup packings at all times by exerting controlled pressure on the packing lip so that it maintains constant contact with the cylinder wall. Thus, effective packing life is increased and leakage due to packing shrinkage is eliminated, it is claimed.

These cup expanders are recommended for use on pumps, compressors, hydraulic presses, jacks, air cylinders, feed mechanisms, lubricators, etc. They are available in sizes for use with all standard hydraulic and pneumatic packing diameters from 1¼ to 2⅞ in.

The series ES-11 are fabricated from 0.010-in. thick specially-rolled strip brass, and they are highly impervious to the effects of brine, gasoline and alcohol. In addition, they can be easily installed, and eliminate the need for special adapters or design changes on clamping plates or other parts, according to the company. They will not increase friction or wear on packings because the controlled pres-

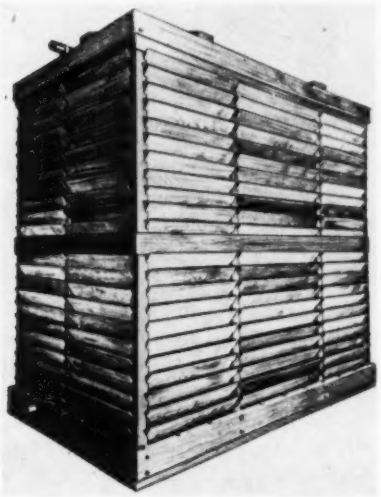
sure exerted is only great enough to properly support the packing.

Contact HPL Manufacturing Co., 15151 Miles Ave., Cleveland 28, Ohio.

Packaged Cooling Towers for Jacket Water Cooling

A line of cooling towers known as "Cotospray" towers have been announced by the Equipment Division of J. F. Pritchard & Company, 903 Grand Avenue, Kansas City, Missouri.

These towers are built of redwood and all bolts, nuts, washers and nails



are galvanized steel. The distribution header is steel and nozzles are bronze, non-clogging type. Louvers are 1-in. surfaced redwood. Basins are leak-proof steel pan type (up to and including 10-ft. 6-in. by 10-ft. size) with redwood sideboards through-bolted to basin sills.

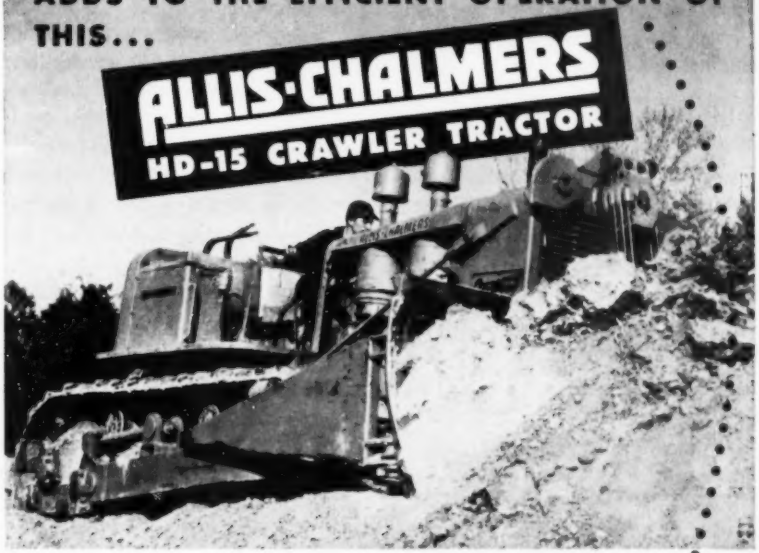
All towers are complete with necessary accessories such as float make-up valves, suction screen and overflow.

Safety Hammer Embodies New Construction Feature

A new and improved type of construction within the hammer head has recently been announced by the Custantite Corporation of Larchmont, New York, manufacturers of the "Flex-Flo" safety hammer.

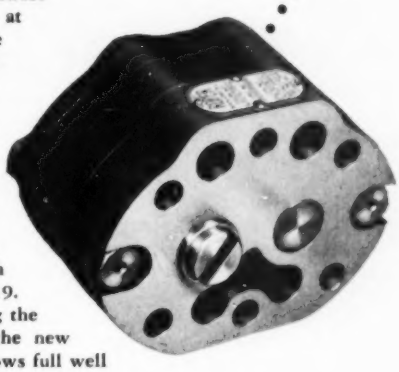
Using a new principle—"controlled compression"—the hammer construction consists of a malleable metal hammer having hollow chambers, the inner walls of which are corrugated. Under continuous heavy pounding,

BOOSTED STEERING
ADDS TO THE EFFICIENT OPERATION OF THIS...
ALLIS-CHALMERS
HD-15 CRAWLER TRACTOR



SPECIAL ROPER PUMP POWERS HYDRAULIC BOOSTER FOR STEERING

This Allis-Chalmers HD-15 crawler tractor, which develops 102 h.p. at the drawbar, is one of four in the line that now sets a new standard in tractor classification. Among the components that keep this 27,500 pound bruiser going is a special Roper Pump — the power hydraulic booster control for steering. Engineered to withstand the most gruelling operating conditions, this pump has more than proved its worth in years of service in the HD-19. Now Allis-Chalmers is providing the same steering performance in the new HD-15. Yes, Allis-Chalmers knows full well Roper dependability.



INVESTIGATE THE ROPER LINE OF STANDARD PUMPS

Roper "Standard" Pumps — Series 3600, F, K, and H — also figure prominently as original equipment in diversified installations. These Ropers provide a wide selection: sizes 1 to 300 g.p.m.; pressures to 1000 p.s.i., and come standard or special fitted depending on the liquid to be pumped. *Send for the Roper catalog and get complete details.*

ROPER Rotary Pumps

SEE OUR CATALOG IN SWEET'S

GEO. D. ROPER CORP.
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ROCKFORD, ILLINOIS

the opposing angles of the corrugations slowly approximate each other at a predetermined rate, thus retarding the compression of the malleable hammer head, and preventing mushrooming.

"Intrimik" for Measuring Bores and Holes

Brown & Sharpe Mfg. Co., Providence 1, R. I., announces their new "Intrimik" for measuring bores and holes directly without masters. It takes inside measurements directly in increments of 0.0001 in. from 0.275-0.500 in. or 0.0002 in. from 0.500-4.000 in. and does this at depths of 2 in. in the three smaller sizes and 3 in. in larger sizes.

By means of an extension, furnished as an extra, measurements are made directly at depths up to 6 in. with three smaller sizes, and at depths up to 9 in. with larger tools. For measurements at greater depths two extensions may be used, permitting measurements at depths of 10 and 15 in.

Three measuring points make line

contacts with the surface of the bore or hole so that the instrument aligns itself accurately both axially and radially. It uses a hardened precision screw, generated and ground on an accurate conic spiral, turning integrally with the rotating micrometer thimble. Measurements are read similarly to those made with a conventional micrometer.

Nowadays, work boats, fishing craft, tug boats and tow boats are powered by tough, efficient diesel engines. Greatly increased life is obtained from these diesels by using chromium plated piston rings or cylinder walls. A porous surface, obtained by preliminary mechanical roughening or electrolytic etching, decreases sliding friction and facilitates distribution of lubricating oils. Thanks to chromium, cylinder wear may be reduced to as little as one-twentieth of that formerly observed, while ring wear may be cut to one-quarter.

Corrosive wear in marine diesels is also reduced by chromium chemicals which establish a passive condition between engine jackets and cooling water. Only 2000 ppm of sodium chromate, constantly maintained, is sufficient to inhibit corrosion in most marine power plants. Submarines and certain other naval vessels provide an additional factor of safety by employing 5000 ppm.

Diesel engines illustrate one of the many fields in which chromium chemicals find important applications. Write for information about the use in which you are interested.

SODIUM BICHROMATE
POTASSIUM BICHROMATE

SODIUM CHROMATE
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MUTUAL CHEMICAL COMPANY OF AMERICA
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270 Madison Avenue, New York 16, N. Y.
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New Literature

Power Unit Catalog

Rivett Lathe & Grinder, Inc., Brighton, 35, Boston, Mass., has published a new catalog describing its line of hydraulic power units in single pump, double pump, and combination pump types.

The catalog 400 lists all information necessary for efficient pump performance. Besides showing working drawings and specifications for the various sizes of pumps, the catalog contains maximum pressures at a given hp. and hp. requirements at given pressures.

The full line of power units which the company offers is shown. Six tank sizes are available with single pumps and four tank sizes with double pumps. Single pump capacities range from .4 gpm. to 40 gpm. at 1000 psi. Double pump capacities range from 3.5 gpm. to 48 gpm. at 1000 psi.

Sleeve Bulletin

Sleeve protection for all operating equipment is briefly described in a new bulletin released by A & A Manufacturing Company, 2017 Clybourn Street, Milwaukee 3, Wisconsin.

Applications are listed for protectors as large as 24 in. diameter and 30 in. long. All sleeves and boots as specified are fabricated to order from neoprene material that is impervious to flying chips, oil, grease and water. "Gortite" sleeves withstand temperatures within a range of —45° F to 220° F. without cracking, it is claimed.

Common uses listed in bulletin AH-2 include sleeves for hydraulic piston rods, lead screws, safety protection over worm drives, gun-mounts, ways on machine tools and for related industrial requirements.

Oiler and Supply Can Catalog

New Gem Catalog No. 100, printed in 6 colors, fully illustrated, contains complete descriptions, specifications, capacities, etc. of their complete line of welded steel bench and pump oilers, supply cans, etc. for machine shops, all industrial users, and mills, mines, etc.

Available free, with price lists, from Gem Manufacturing Corporation, Department SDP, 1129 Goebel Street, Pittsburgh 33, Pa.

Gage Blanks Standards

The fourth edition of Gage Blanks, Commercial Standard CS8-51, has been issued by the Commodity Standards Division of the United States Department of Commerce. Printed copies, first prepared for the military services which were in urgent need of them, are now for sale by the Superintendent of Documents, Washington 25, D. C., at 30¢ a copy. Manufacturers needing this standard for use in connection with government contracts may obtain copies through the contracting officers.

The Commercial Standard embodies the results of a thorough review of gaging practice which was undertaken by the American Gage Design Committee in 1945. A number of changes and additions to the standard were found to be desirable to take advantage of developments during the preceding war period. Standard designs are given for adjustable plug gages, wire type plug gages, machine taper gages, spline gages, and mountings for dial indicators. In addition are items previously covered, including plain and thread plug gages, plain and thread ring gages, adjustable snap gages, adjustable length gages, and master disks. Recommendations are also given for the application of AGDC design standards to special types of gages.

Stud Welding Maintenance Manual

"Maintaining Your Stud Welder" is the title of the new maintenance manual being offered to industry by KSM Products, Inc., Merchantville, N. J. The handbook is a companion piece to the company's operating manual.

Designed for convenient reference by those charged with maintenance of stud welding apparatus, the 12-page handbook contains 8 drawings and

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The "GRACE MORAN," other Moran tugs and many other vessels, power plants, railroads and transport lines have proved over the years that Briggs Oil Clarifiers improve engine performance by keeping lube oil clean.

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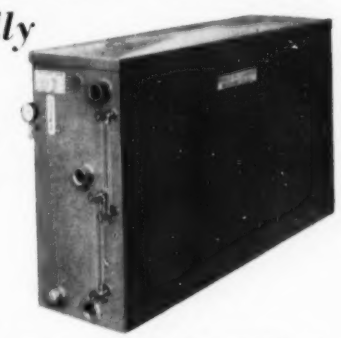
PROVE IT YOURSELF

Send us a sample of your oil and engine specifications. We will gladly make a laboratory test and give you our engineers' recommendation—no obligation, of course.

A Briggs Catalog belongs in your file—write for one NOW!



BRIGGS CLARIFIER—MODEL CD
(Filter, Strainers and Oil Storage Tank—in one unit)

THE BRIGGS FILTRATION COMPANY
RIVER ROAD, WASHINGTON 16, D. C.

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FOR MORE THAN A QUARTER CENTURY

charts and 12 photographs. Accompanying text helps to explain the various aspects of maintenance against a background of specific components and problems. The manual is divided into three basic sections: general information, maintenance, and accessories.

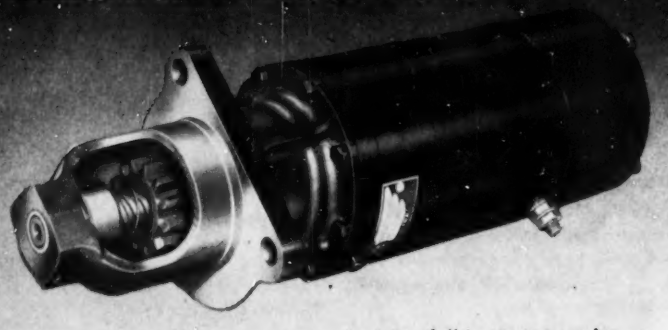
"Rustshield" Booklet

"Rustshield 2", a chemical treatment that produces an oil-retaining rust-proof surface for moving metal parts, is described in a new 4-page publication by Octagon Process, Inc., 15 Bank Street, Staten Island 1, N. Y.

Printed in two colors, the booklet discusses application methods and advantages of using the treatment on sliding and bearing surfaces. A great variety of precision parts and defense components are given the treatment to meet U. S. Army Ordnance Specification 57-0-2C, Type II, Class A, and Military Specification MIL-C-16232 (Ships), Type I.

FOR QUICK SURE STARTING Specify Leece-Neville CRANKING MOTORS

No other motor built can match Leece-Neville for reliability, long life and top performance. High torque makes instant breakaway, even with cold, stiff engine. Fast cranking speed insures quick start. It will pay you to specify L-N.



★ Now producing cranking motors, generating systems, pump motors and special equipment for military engines.

And for *full* batteries...always, specify L-N Alternators. The Leece-Neville Co., Cleveland 14, O.

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ALTERNATOR SYSTEMS • GENERATORS
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TRUCK BUS DIESEL OFF-HIGHWAY
PASSENGER RAILROAD MARINE INDUSTRIAL

Metal Hose Bulletin

An illustrated bulletin, CMH-124, describing flexible metal hose and tubing for diesel applications has been released by Chicago Metal Hose Corporation, 1315 So. Third Ave., Maywood, Illinois.

This bulletin deals with CMH diesel exhaust hose—Rex-Weld corrugated types for higher pressure installations and Rex-Tube convoluted types, essentially used where long length of flexible exhaust tubing is required. Also covered are Rex-Weld types for diesel air, oil and fuel lines, and standard fittings for all diesel exhaust hose types. The new bulletin was published to meet the widely expanding conditions in the diesel industry

"Jobs You Can Do With Bronze Electrodes"

An 8-page reprint entitled, "Jobs You Can Do With Bronze Electrodes", has been written by F. E. Garriott, manager of the Weldrod department of Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 46, Wisconsin.

Completely illustrated, this booklet describes the welding techniques and correct choice of bronze electrodes to be used in welding water heaters, turbine runners, cast-iron gear housings, galvanized iron exhaust stacks, bearings, dies, etc.

Machinery Parts Booklet

A wide variety of cast and wrought alloy parts now being used in many industries to solve abrasion, corrosion, and high-temperature problems are described in a new 24-page booklet, "Long-Wearing Machinery Parts". More than 60 blueprints, tables, and photographs show some of the sizes and shapes in which these parts are being used. The booklet is available from Haynes Stellite, a Division of Union Carbide and Carbon Corp., P. O. Box 746, Kokomo, Indiana.

The parts described are made of the various cobalt-, iron-, and nickel-base alloys which have had wide use as metal-cutting tools, jet aircraft parts, chemical equipment, and many types of valves and furnace parts.

For the benefit of those who may have a particular machinery part

which has failed repeatedly, there are information forms included in the booklet. When filled out to describe the maintenance problem involved, this form will help assure that the right alloy is recommended for the job.

Gage Block Catalog

The Fonda Gage Company, Inc., 59 Daly St., Stamford, Conn., announces the publication of their catalog in a new and revised 1952 edition. In it are described the complete lines of carbide and steel gage blocks with current prices of both individual gage blocks and sets. It is illustrated with photographs of the blocks themselves and of their applications.

Bulletins on Aids for Maintenance

Aviation-Industrial Division Service section of Fine Organics, Inc., 211 East 19th St., New York 3, N. Y., is offering technical and practical data, relative to the nature and uses of their line of solvents, cleaners and emulsions.

New Bulletins issued are: "Emulsion Cleaners", Vol. 1-2; "Safety Solvents", Vol. 1-4; "Supplementary Technical Information", Vol. 1-5; and "Instrument Cleaners", Vol. 1-6.

Bearing Booklet

"Facts Illustrated", now being distributed by the Dura-Bond Bearing Company, 715 Loma Verde Avenue, Palo Alto, California, portrays in text and pictures the differences between the so-called "all round" camshaft bearing and its counterparts, the split and interlock types.

Covered in this booklet are such items as the differences in precision, methods of manufacture, profit comparison, and other subjects.

ASTM Standards on Petroleum Products and Lubricants

This 1951 compilation of ASTM Standards on Petroleum Products and Lubricants brings together in compact form most of the ASTM Standards, test methods, and specifications widely used in this field.

Prepared by the American Society for Testing Materials Committee D-2 on petroleum products and lubricants, this edition gives in their latest form 129 ASTM standards, including 116 test methods, 7 specifications, 1 classification, 3 lists of definitions relating to petroleum, specific gravity and rheological properties of matter, 2 tentative recommended practices for the purchase of uninhibited mineral oil for use in transformers and in oil circuit breakers, and for designating significant places in specified limiting values, and other material.

Standards cover many classifications of petroleum products, including diesel fuels.

Copies of this 804-page book can be procured from American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., at $5.75 each, heavy paper cover; $6.40, cloth cover.

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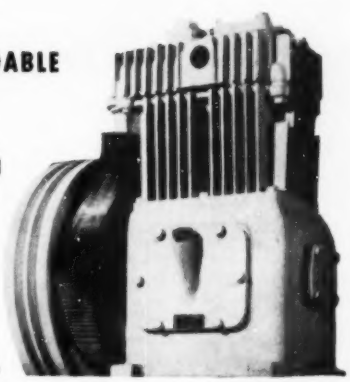
IN YOUR BUSINESS...

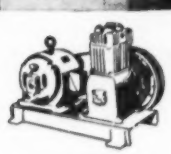
Quincy COMPRESSORS FOR DEPENDABLE COMPRESSED AIR SUPPLY

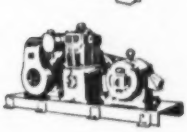


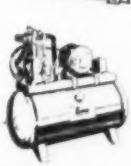
It may not be a matter of life and death, but there's a great peace of mind that goes with owning a Quincy Compressor. For you can depend on Quincy to deliver the compressed air required for the job. Quincy Compressors are modern, compact and ruggedly constructed for long use.

There's a Quincy Compressor for *your* job! Depend on a Quincy specialist to help you select the type and size (from 1 to 90 c.f.m.) to meet your specific needs.

Write Dept. J-24 for details.







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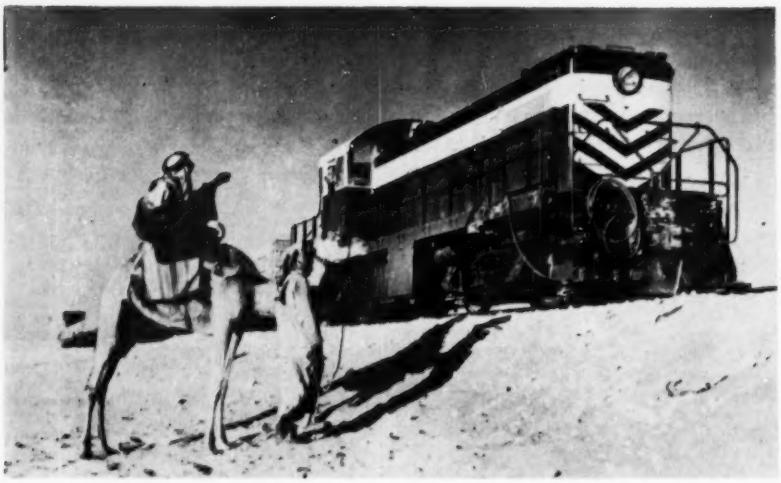
Field Notes



Alco-GE Helps Train Saudi-Arab Railroaders

Arab youths, many of whom had been brought up as desert camel herders, are today training as locomotive enginemen, train dispatchers, station agents and diesel mechanics to operate the new, 350-mile Saudi Government Railroad.

As part of this extensive training program, a hand-picked group of 12 Arabian youths recently completed an intense two-week course in operation and maintenance at the Alco-GE diesel-electric locomotive school at American Locomotive Company's plant in Schenectady, N. Y. Thousands of U. S. and foreign railroad men have attended this school, which was established in 1946 to acquaint railroaders with the construction, operation and maintenance problems of the diesel-electric locomotive.

Under construction for four years, the main line of the Saudi Government Railroad was formally placed in operation by King Ibn Saud in October, 1951. The road, which carries passengers, food, supplies and building materials as well as oil field equipment from the Persian Gulf to the capital at Riyadh, was built by the Arabian American Oil Company. However, the $50 million cost is being financed by the Saudi Government out of oil royalties.

New Smelting Lines at Point Comfort

The first of two new smelting lines was set into operation at the Point Comfort Works of Aluminum Company of America.

The new line increases Point Comfort's production capacity to about 135,000,000 lbs. of aluminum annually. The second line is scheduled for completion within three months.

The Point Comfort smelting facilities are operated with electrical power generated through the use of natural gas. When the plant reaches full production, it is expected that gas consumption will rise from the present 30,000,000 cu. ft. per day to about 50,000,000. The capacity of the power plant will be raised from 120,000 kw. to about 200,000 kw.

Seventy-four new Nordberg radial gas engines are being installed to supply electricity for the new potlines. These will be in addition to the 120 engines which make up the original power plant. The new engines will be similar to those already operating, except that they will have 12 cylinders instead of 11 and will have about nine per cent greater output per engine.

Alcoa's Point Comfort Works was the first to adopt the radial gas engine for generating power in making aluminum. It started production in February 1950, to become the first new aluminum producing plant built after World War II.

Refining Division, API, Meeting

The Division of Refining, American Petroleum Institute, is holding its mid-year meeting at the St. Francis Hotel, San Francisco, May 12 through 15.

Ten group technical sessions and an open dinner meetings are on the 4-day program. Among the subjects to be covered are analytical research, electrical equipment, corrosion, industrial communications, automotive fuels, production and recovery of aromatics and atmospheric pollution. The central theme will be industrial communications.

DEMA Promotes "Code of Ethics For Interviewing Procedures"

The Diesel Engine Manufacturers Association is interested in the diesel field's getting the best young engineers out of the colleges. To do this they must offer good training opportunities and explain those opportunities so that young engineers will know about them.

As a help to this end the Association is distributing "Code of Ethics of Interviewing Procedures", reprinted from the "Journal of Engineering Education". This article was prepared by the Committee on Ethics of Interviewing Procedures, American Society for Engineering Education and endorsed by the Engineers' Council for Professional Development. It outlines the responsibilities of the industry, the college and the student.

If your company has printed literature telling what you do with new engineering graduates after you get them, DEMA will appreciate receiving a copy.

British Promoting Inventions and Development

The challenge presented to American development engineers and manufacturers by rising British inventive competition is discussed in the current issue of "Bibliography of Technical Reports" now available from the Office of Technical Services of the U. S. Department of Commerce.

According to this article, the British Government has been promoting industrial development and inventive skills through the work of various agencies. In June, 1948 a National Research Development Corporation was set up by law to further the development of inventions which were not being sufficiently exploited, and to protect such rights as were involved in these developments. In addition, the corporation extends aid to develop such inventions that cannot be immediately put into production.

In March, 1947, the Royal Commission on Awards to Inventors was re-established, manifesting the government's interest in furthering inventive genius through honor and cash awards to inventors in department levels and on a Crown level. From 1919-1937 this Commission made awards equivalent to 6 million dollars after appraising numerous discoveries and inventions.

Fifty Years for Stewart & Stevenson

Fifty years ago two young men entered into a partnership contract "for the purpose of doing and conducting a general blacksmith and carriage business in the City of Houston."

The men were C. Jim Stewart and J. R. Stevenson. Today that organization has enlarged its scope to encompass four separate companies: C. Jim Stewart & Stevenson, Stewart & Stevenson Services, Stewart & Stevenson Distributing Company, and the Alemit Company of the Gulf Coast.

The parent company, C. Jim Stewart & Stevenson, specialized in the early days in blacksmithing, wood working, trim and painting of carriages and wagons.

In 1905, for the first time, C. Jim Stewart & Stevenson were called on to do their first work on a horseless carriage—the rebuilding of a badly burned Dixie Flyer automobile. That was the beginning of the transition for the company that today specializes in body and fender repair, reupholstering, seat covering, wheel alignment, repainting and Hertz truck leasing.

In 1937 C. Jim Stewart & Stevenson went into the diesel business with the organization of their fourth company, Stewart & Stevenson Services at 4516 Harrisburg St. Today the largest distributor of General Motors' diesel engines in the world, they worked during World War II primarily under Army contracts, providing between 1200 and 1400 power units for every branch of the service at home and overseas, in addition to rebuilding almost a thousand jeeps and 4000 diesel engines for combat.

In their fiftieth year of operation, C. Jim Stewart & Stevenson and allied companies are controlled by one of

here's the "OUNCE OF PREVENTION" for your Engine

It's better . . . and more economical . . . to prevent engine damages than to repair them! That's why your engines *need*, and should have, the protection of PENN Safety Controls.

And even the best engines can develop minor troubles in lubricating and cooling systems which can lead to engine damage. But, with the PENN Safety Control on the job, such damage is avoided.

Learn more about this low-cost protection for *new and old engines.* Three models are available: one for oil pressure, another for water temperature, and a combination pressure and temperature unit. Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.

Typical Functions of PENN Safety Controls

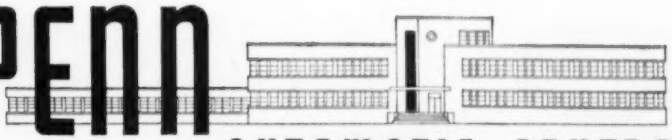
Diesel Applications. Sounds an alarm . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

Battery Ignition Applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications. Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds alarm or lights signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.

PENN



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

the original founders, J. R. Stevenson; by his son, J. Donald Stevenson, and by the second and third generation of Stewarts—Ross Stewart and his son, C. Jim Stewart II.

Reports on Foundry Improvements

Reports which may help increase productivity in the foundry industry are reviewed in the current issue of the Technical Reports Newsletter, just released by the Office of Technical Services of the U. S. Department of Commerce.

The reports include an improved metal casting process which is faster and cheaper; a bibliography of suitable motion pictures and film strips intended to show the foundry worker improved working methods; and two extensive surveys on U. S. productivity in the brass and grey iron foundry fields.

Also reviewed are two research reports that indicate the progress made in increasing our scientific knowledge of the element, silicon, that may lead to obtaining this element in a ductile metal form.

Locomotive Figures

Class I railroads in 1951 installed more new locomotives in service than in any year since 1923, but at the same time retired more from service than ever before, the Association of American Railroads announced recently. Despite the record number installed, there were 1579 fewer locomotives, or 4.4 per cent, in service on January 1, 1952 than one year ago, but average tractive power was 4.8 per cent greater, due to the new locomotives being more powerful.

New locomotives put in service by Class I railroads in 1951 totaled 2558, of which 2537 were diesel, 18 steam and 3 electric. Locomotives installed in 1950 totaled 2396, of which 2373 were diesel, 12 steam and 12 electric.

Class I railroads retired in 1951 a total of 4137 locomotives, of which steam totaled 4083, electric 13 and diesel 41.

On January 1, 1952 these roads had 1739 new locomotives on order, the largest number awaiting delivery on January 1 of any year on record. Locomotives on order at the beginning of this year included 1719 diesel, 19 steam, and 1 electric.

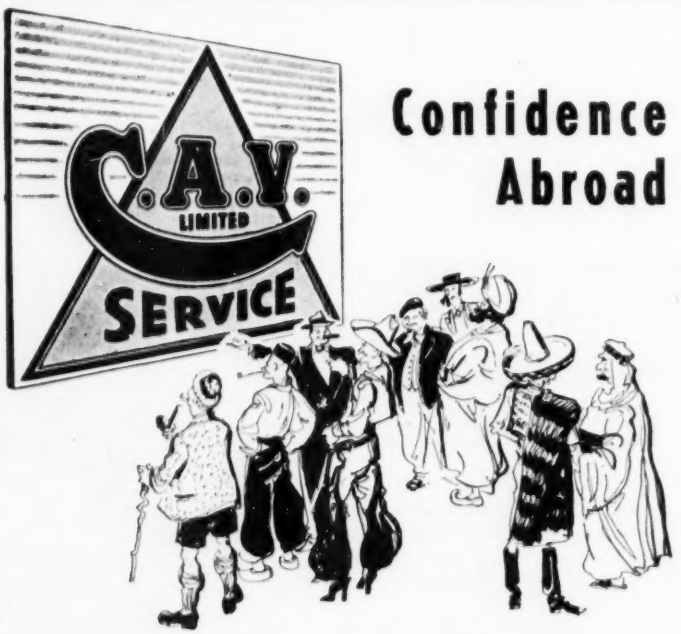
Also these railroads had 34,217 locomotives on their lines on January 1, 1952, compared with 35,796 on January 1, 1951. The total ownership of locomotives at the beginning of this year was 7235 less than at the time of Pearl Harbor in 1941.

Purolator Acquisition

Acquisition of Petroleum Accessories, Inc., of Detroit, manufacturers of large capacity fuel filters, was announced recently by Purolator Products, Inc., manufacturers of filtration equipment.

The acquisition will broaden the Purolator line and add to production facilities as well. Equipment is now being moved from Detroit to the plant at Ringtown, Pa., where the operation will add substantially to employment in that area.

Petroleum Accessories, Inc., which



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Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

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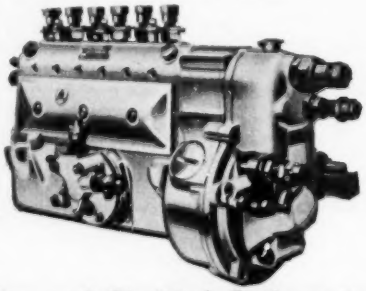

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for the present will be operated as a division of Purolator, was acquired through an exchange of stock. Roland Burks, former president, will remain with Purolator headquarters in its Detroit sales office. Darnell Burks, his brother and co-owner, will move to Ringtown to head manufacturing operations there.

FPC Authorization Sought for New Natural Gas Facilities

Three subsidiaries of the Columbia Gas System, Inc., have asked the Federal Power Commission for authority to construct and operate a total of approximately 94 miles of natural gas pipelines on their transmission systems in Ohio, Pennsylvania and New York.

The companies said the construction would improve and increase the deliverability of their transmission systems to help assure continuous service to existing customers and provide for normal growth in their service areas.

Manufacturers Light and Heat Co., one of the subsidiaries, is proposing to construct a total of about 40 miles of new pipeline in Allegheny, Washington and Beaver Counties, Pa., and Belmont, Jefferson and Columbiana Counties, Ohio. The company also plans to retire approximately 34 miles of pipeline in Allegheny, Washington and Clarion Counties, Pa., and Belmont and Columbiana Counties, Ohio. In addition, a compressor station in Lawrence County, Pa., and a compressor unit in Columbiana County, Ohio, will be retired.

Another subsidiary, Natural Gas Co. of W. Va., wants permission to construct a total of 21 miles of pipeline in Columbiana and Stark Counties, Ohio, and to retire two compressor units in Belmont County, Ohio.

Home Gas Co., the other subsidiary, is seeking authority to build approximately 32.5 miles of pipe line in Chemung and Broome Counties, N. Y.

Estimated net cost of the project is $3,829,677, consisting of $2,111,077 for Manufacturers, $618,600 for Natural, and $1,100,000 for Home. The companies said they would obtain the money from their parent, The Columbia Gas System, Inc.

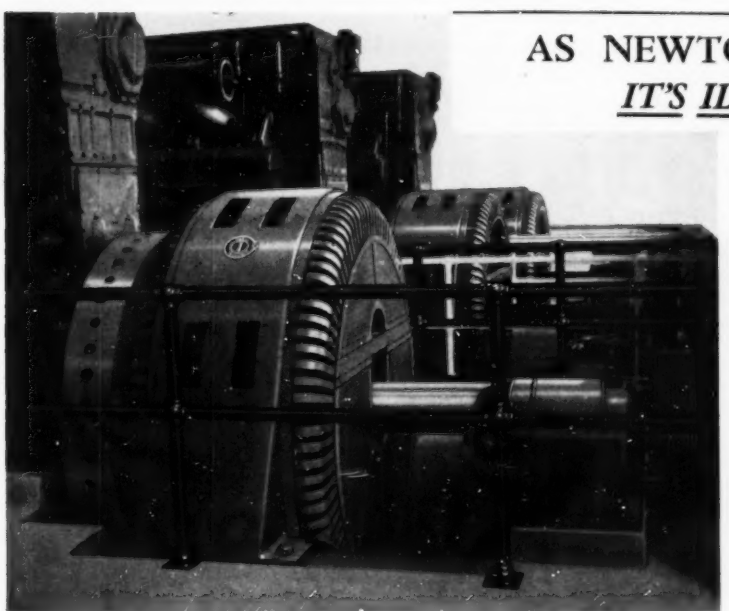
Packaged Intake Air Cooler Development

Some activity is reported in "Packaged Intake Air Coolers." Waste exhaust heat is used in an absorption type refrigeration system. It is claimed that a 1000-hp., 4-cycle turbocharged engine with exhaust temperature of about 800° F can produce at least 50 ton of refrigeration in the form of 400° F chilled water. Works like intercooling in providing cooler, higher-density air for scavenging. Being ahead of the blower, higher blower efficiencies are obtainable.

M.I.T. Offers Special Courses

Special courses in internal combustion engines and in lubrication engineering will be offered by the Massachusetts Institute of Technology this coming summer session.

The program in internal combustion



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Three years ago the city of Newton Falls, Ohio purchased and installed an Ideal 1000 KW Generator. Two years later it was necessary to expand the generating capacity of their plant. They were so well pleased with the high standards, promptness of service, quality and efficiency of Ideal equipment that they purchased two more Ideal Generators — with companion switchboards.

You can also be assured of having the same advantages of quality, experience, demonstrated ability, and pleasant fair dealing, when you purchase your Generators, Motors, and Switchgear from the Ideal Electric & Manufacturing Company.

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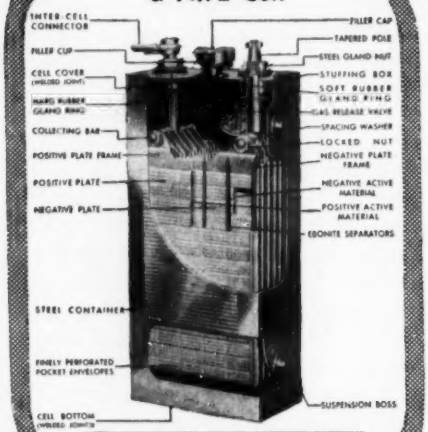

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engines from June 9 to June 20 will emphasize the analytical approach to performance and design problems and to the planning and control of experimental and development programs. It is planned primarily for the engineer responsible for the design and development of improved models of diesel or Otto cycle engines, and for the teacher of these and related subjects. The course will be under the direction of C. Fayette Taylor, professor of automotive engineering and director of the Sloan Laboratories for automotive and aircraft engines.

Lectures in the course will be followed by discussion periods and in many cases by laboratory demonstrations as well as by conducted visits to related laboratories, including those for experimental stress analysis, dynamic strength of materials and gas turbines.

A specialized program in lubrication engineering will be offered from June 23 to July 3 to provide an opportunity for engineers in industry to study the application of new techniques and methods in this field. This program has the sponorship of the American Society of Lubrication Engineers and other technical groups. It will be under the direction of Professor Brandon G. Rightmire, assistant professor of mechanical engineering and in charge of the M.I.T. lubrication laboratory. He will be assisted by other engineers on the faculty and by representatives from industry.

Other courses given deal with metal cutting (May 26-June 6); vibration (August 4-15); and the photoelastic method of stress analysis (August 18-30).

OGP Plans Buffalo Conference

Buffalo, New York will be the scene of the 24th Annual Conference and Exhibit of the Oil and Gas Power Division, ASME. The meeting will take place starting on June 23 through 27.

Several interesting technical sessions have been arranged around the general theme of "design". Included will be sessions dealing with crankshafts, lubrication, ignition of high compression gas engines and plant design. In addition, there will be a panel discussion on the topic "Engines of High Specific Output". Panel members will represent the viewpoints of the Navy and industry. This is a follow-up of the very popular panel discussion that have been features of the Annual Conference in recent years.

The special OGP lecture series will again be conducted and the subject will be "Heat Transfer". The lecturer will be C. F. Taylor of M.I.T. In addition there will be a meeting of the General Technical Committee, which is another of the panel-type discussions. Considerable interest has been aroused in recent meetings of this Committee.

The Oil and Gas Power Division has been honored this year in that Mr. R. G. S. Pigott, President, ASME, will present a paper during the technical session on engine combustion.

Inspection trips have been arranged, the high points being a visit to the

Schoellkopf hydro-electric plant at Niagara Falls, followed by a dinner at the General Brock Hotel overlooking the falls.

An all-day trip is planned for June 27 to Olean, New York, where arrangements have been made to tour the facilities of Clark Brothers, Co., Inc. and the Van der Horst Corporation.

RR Fuel Buying Pattern Reflects Trend To Diesels

Dieselization of the nation's railroad system progressed to such an extent during 1951 that purchases of diesel fuel by the railroads were boosted more than 25 per cent over the previous year, the Eastern Railroad Presidents Conference said recently.

The group pointed out that it is a mark of the railroads' contribution to conservation of petroleum resources, since the use of diesels entails a much lower overall consumption of oil than does the use of oil-fired steam locomotives.

Dieselization of railroads has proceeded at a greatly accelerated rate since the end of World War II, the Conference said, noting that almost 14,000 new diesel units have been put into service since V-J Day. At the same time, steam locomotives have been retired at a rate of nearly 3000 a year, with the result that some of the roads have already achieved complete dieselization and others are rapidly approaching this goal.

Short Diesel Courses

The following seven schools have scheduled short courses for 1952 for men who now operate diesel engines in these states. These conferences are being set up by the engineering extension departments of the schools sponsoring them:

University of Kansas, Lawrence, May 15, 16, 17; Iowa State College, Ames, July 21, 22, 23; University of South Dakota, Vermillion, August 5, 6, 7; University of Nebraska, Lincoln, October 16, 17, 18; University of Missouri, Columbia, October 20, 21, 22; University of Illinois, Monticello, October 27, 28, 29; Oklahoma A & M College, Stillwater, November 17, 18, 19.

A small registration fee will be charged. Enrollment is not limited to the states in which the schools are located.

The Diesel Engine Manufacturers Association is doing all possible to help make these sessions successful. In addition to the normal help of getting speakers, arrangements have been made for Prof. B. S. Davenport of Oklahoma A & M College to attend all of these sessions and act as DEMA's coordinator.

A & D Diesel Moves

New and enlarged quarters will be occupied shortly by A & D Diesel Service, Inc., Brooklyn, N. Y. The new building is located at 145 21st Street —one half block from their present address.

This additional space—2500 sq. ft. —with drive-in facilities for two trucks will provide more prompt and efficient service. New shop equipment being acquired is a Robert Bosch fuel in-

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A & D Diesel Service was founded 7 years ago by Vincent D'Aversa and associated with him is William L. Fetherston, formerly with American Bosch Corporation.

Pipeline Crude Purified For Use as Diesel Fuel

A Sharples continuous centrifuge used with a unique fuel storage method makes it possible to purify pipeline crude oil for use as a fuel in pumping station diesel engines. The non-cratering purified fuel is free of dirt, tank scale and moisture and is not re-contaminated in storage.

Installations now in operation are successfully processing crude from the oil fields of Texas, California, Illinois, Louisiana, Wyoming and Canada, and the purified fuels are being used in a number of different types of medium-speed diesel engines. Actual station data shows that the total quantity of pipeline crude required to supply pumping station engines usually falls within the shrinkage allowance of the station.

Koppers Limits Piston Ring Production

Koppers Company, Inc., recently announced that it will confine its piston ring manufacturing operations to aircraft and industrial rings. The plant had heretofore also produced automotive rings.

In addition to providing facilities for the expanding industrial ring production, the change also will release space needed to expand operations of the nearby Bartlett Hayward plant.

Perfect Circle Gains Subsidiary

Purchase of the entire stock holdings of Centrifugal Foundry Company, Muskegon, Michigan, by Perfect Circle Corporation of Hagerstown, Indiana was announced recently. With completion of the purchase Centrifugal Foundry becomes a wholly-owned subsidiary of Perfect Circle. The name of the firm will not be changed at this time.

W. B. Prosser, Perfect Circle vice president and general manager heads the Muskegon organization as president. Former president and general manager of Centrifugal Foundry, A. G. Anderson is vice president and general manager. Secretary-treasurer of the new organization is George Rea, P. C. secretary-treasurer. Phillip F. Hartman, of Muskegon, is assistant secretary-treasurer.

Seattle Chain Changes Name

It was announced recently that the name of Seattle Chain & Mfg. Co. has been changed to Round Seattle Chain Corp. The company is located at 6921 East Marginal Way, with branches in Portland and Bellingham, Washington.

The new name of this company, which was acquired by the Round group in 1920, identifies it more closely with the nationwide Round organization. There has been no change in ownership or management.

ADD VALUABLE YEARS WITH S-N GEARS

Snow-Nabstedt has manufactured top quality Reverse and Reduction Gears for 46 years. Our gears have increased the usefulness of pleasure and commercial boats everywhere.

"Pioneer", veteran dragger of Boston, was repowered with a 175 H.P. Cummins Diesel with S-N superior cone clutch and the heavy duty herringbone reduction Gear.

"Catherine Paladina", a 22-year-old otter trawler of A. Paladina, Inc., Calif., was repowered with a 270 H.P. "Cat" Diesel using S-N push button air-controlled Gears.

"Henry O. Underwood" of Jonesport, Me., first of the new designed sardine carriers, was equipped with 160 H.P. Buda Diesel and S-N balanced reverse Gear which transmits 100% engine speed in reverse.

Hydraulic

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Texas Gas Income Rises 28% in Year

Gross operating revenues of the Texas Gas Transmission Corporation in 1951 increased to $39,511,000, a gain of 28 per cent according to the pipeline's report.

To meet the steadily rising demands for natural gas, the company said, a $33,700,000 pipeline expansion program is planned for 1952. This project will raise the daily delivery capacity of the company's system to a total of over 950,000,000 cubic feet daily.

Tax Amortization Program Benefits Small Oil Refiners

The relative share of modern petroleum refining facilities owned by small refiners (20,000 bbl. per day or less) in the U. S. will be significantly increased through refinery construction encouraged by accelerated tax amortization.

A recent report to Secretary of the Interior, Oscar Chapman, was based on an analysis of certificates of necessity for new refining facilities recommended by the Petroleum Administration for Defense to the Defense Production Administration. These certificates represent about one million bbl. of additional refining capacity.

400 Toolmakers Show Products

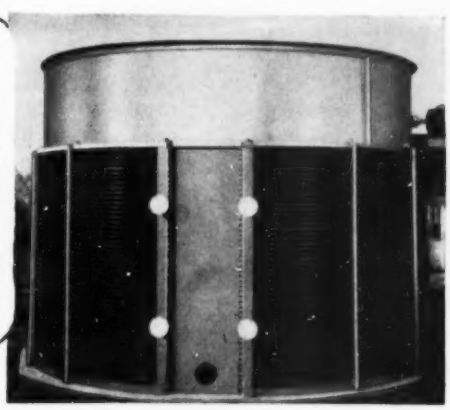
More than 400 toolmakers displayed their products at the industrial exposition, sponsored by the American Society of Tool Engineers at Chicago recently.

Latest engineering advances were discussed at technical meetings held in the Conrad Hilton hotel. Society officials and guest speakers stressed the development of new machines to meet the manufacturers' problems of manpower shortages, high costs and lack of skilled labor.

NBS Studies Stress Corrosion

Stress-corrosion cracking, caused by the combined action of stress and corrosion, can be responsible for the spontaneous service failure of objects ranging from brass cartridge cases to stainless-steel coffee urns. Although the problem is an important one, much remains to be learned about its mechanism. A continuing investigation at the National Bureau of Standards, conducted by Hugh Logan of the NBS corrosion section, now provides new data on some of the mechanical and electrochemical phenomena involved.

Corrosion is generally considered to be an electrochemical phenomenon, involving the flow of minute electrical currents between areas of different potential. When most metals are exposed to ordinary atmospheres, a thin oxide film is quickly formed that tends to protect the metal from further corrosion. According to the most generally accepted theory, which NBS study tends to confirm, stress-corrosion cracking starts with a scratch or break in this protective film. When the protective film is broken through, the freshly exposed metal is more anodic (more negative) than the surrounding film-covered surface, and if moisture



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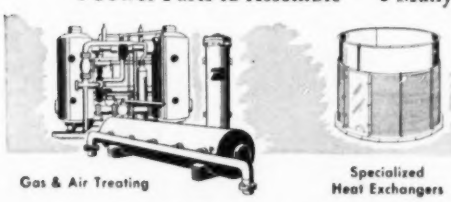

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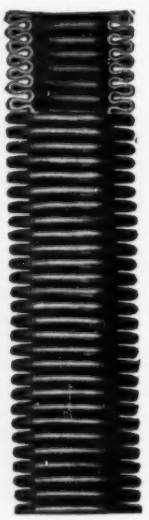

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is present an electric current flows that causes the metal to be removed from the exposed area, that may eventually lead to parts failure.

Intercity Buses Ruled Essential

The Defense Transport Administration has been advised by Secretary of Commerce Charles Sawyer that "intercity bus transportation" has been added to the list of essential activities.

In a letter to DTA, Secretary Sawyer said that a revised petition of DTA, requesting inclusion of the intercity bus industry on the list had been approved upon the recommendation by the Interagency Advisory Committee on Essential Activities and Critical Occupations, following several hearings in which DTA was represented by its Street and Highway Transport and Manpower divisions and by interested industries.

Employment Increase in Metalworking Industry

Employment in metalworking industries has been steadily increasing since December and is expected to continue through March, according to a survey by the Bureau of Labor Statistics for NPA.

The survey was made to ascertain (1) the effect of sharply reduced allotments of critical materials for civilian production during the first quarter of 1952, and (2) to aid NPA and the Defense Production Administration in reviewing second quarter allotments for the third quarter.

It has been recognized that the greatest employment problem in any mobilization is that of synchronizing the loss of jobs in civilian production plants with the increase of work in defense plants. As a result of the survey there is now an accurate estimate of the impact of cutbacks in civilian production on the metalworking employment situation in specific industries, types of producers and areas as well as nationally.

The survey shows that American industry, even in the consumer durable goods field where material cutbacks were most severe, has generally been able to find a means of maintaining and even increasing employment

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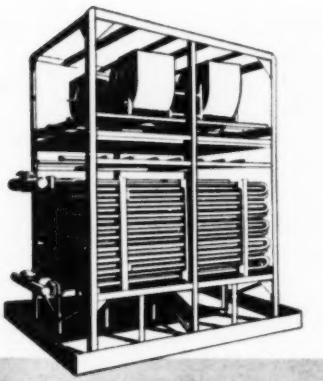

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Here's how to beat slime and scale. First, add a little Oakite Composition No. 22 to water supply and operate until free of slime. Circulate Oakite Compound No. 32 through spray nozzles to remove scale. Finally, treat your water with Oakite Airefiner No. 52 to prevent further slime and scale build-up.

Results? Condensers operate at top efficiency.

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through substitution and conservation of scarce materials, and the placing of defense contracts in spite of the impact of sharply reduced allocations of metal for their normal products.

Natural Gas Industry Becomes Giant in Decade

Today the nation's natural gas gathering, transmission, and distribution lines exceed 315,000 miles — 90,000 miles more than railroad rights-of-way.

In the last five years the industry has spent over 4 billion dollars for new lines and equipment, and expects to spend another 4 billion for similar purposes by the end of 1955.

Present goal of natural gas transmission companies is the rich New England territory. To this end two companies, the Northeastern Gas Transmission Co. and the Algonquin Gas Transmission Co. are waging some mighty legal battles for the right to serve this area.

By the end of this year it is estimated that production will be well in excess of 7.5 trillion cu. ft. or triple that of only fifteen years ago.

London Buses Tour U. S.

Three double-decker London buses are visiting more than 40 major U. S. cities on a coast-to-coast good-will tour from March 18th through July 11th.

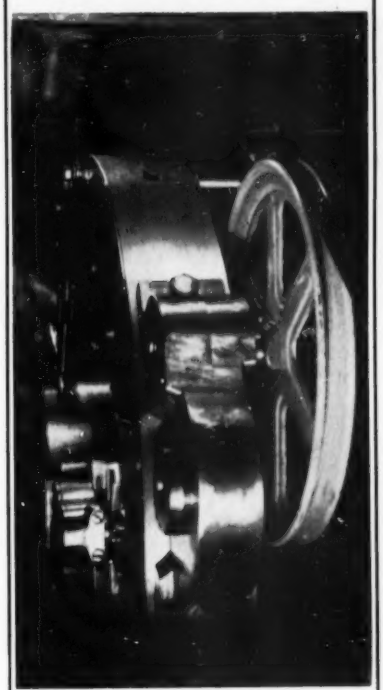
Socony Vacuum has seen to it that special supply depots were established throughout the nation to insure refueling at the necessary intervals, as the buses can only carry 300 miles worth of diesel fuel.

The buses are part of a fleet of 7250 double-deckers developed especially for the London Transport Executive, which serves 10,000,000 persons in an area of about 2000 square miles. The sponsor of the caravan is the British Travel Association.

Although two different manufacturers produce the chassis-engine units, and two others build the bodies, all parts are completely interchangeable, making it possible to substitute a complete body, for example, and have a damaged machine back in service within a few hours.

Engines are 6-cyl., overhead valve, 125-hp. jobs, and average 7.6 mpg.

CRANK PINS *REFINISHED* IN PLACE



Our crank pin turning machines — designed and developed along with the Diesel Industry — are available to save you time and expense.

We are repeatedly effecting great savings for our customers throughout North and South America with this complete line of portable equipment.

Crank pins ranging in size from six through twenty inches in diameter may be refinished within factory tolerances without the necessity of removing the crankshaft from the engine. All work guaranteed.

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FOR POWER TRANSMISSION
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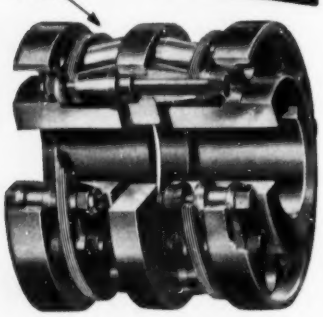

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Significant MAN Development

Recent development of a new crosshead type engine turning about 400 rpm. by MAN, Germany, has been reported. Of unusual interest is the fact that bmep's in the order of 240 are reported normal with extensive testing going on with considerably higher pressures.

A compound high pressure turbocharger incorporating nine stages of axial flow compression and one of centrifugal compression are understood to be used. It is also said to be inter- and after-cooled. Supercharging pressures are reportedly in the order of 38 psi. and more than usual excess air is used.

Efficiency is said to be very high with fuel consumption per bhp. 0.38. At these elevated pressures (peaks with a good fat indicator card are reported at 1600 psi.) temperatures are said to be relatively low. Little heat is apparently rejected to the jacket water and exhaust temperatures are quoted as being comparable to those of normally supercharged engines.

More details are being sought and will be reported as received. There is currently considerable interest being shown in this development in this country. Some details were given by Dr. E. C. Magdeburger, head engineer and technical advisor, diesel engines, Bureau of Ships, United States Navy, in a short article in the February, 1952 issue of the "Journal of the American Society of Naval Engineers, Inc."

Book Review

Selling to Industry—by Bernard Lester, 255 pages, The Industrial Press, 148 Lafayette St., New York 13, N. Y., Price, $3.50.

This is a compact, pocket-size book that has been written as a manual of practical ideas and suggestions for the sales engineer who wants to analyze and improve his methods of finding, contacting, selling and servicing industrial customers.

The author has set forth in a brief and realistic way those key points which have, from experience, been found to be most effective. He writes from a wealth of experience as sales execuitve for Westinghouse Electric Corporation, lecturer on sales engineering and marketing at the University of Pittsburgh, Stevens Institute and Brooklyn Polytechnic Institute and as a consultant on machinery and equipment marketing and selling.

The book is written in the form of short easy-to-read articles and grouped in a series of sections entitled: "Prospects are our Market; Just How do Prospects Buy; Sales Program Essentials; Make the Sales Program Effective; Successful Sales Interviews; Sell the Prospect's Employees; Be a Better Equipment Salesman; Getting Help from Others; Use All Our Sales Tools; Meet the Prospect's Objections, Follow Up the Customer's Decision; Grow in Power and Sales Skill; and When Orders Hang on Trees."

This book is well and interestingly written and should be instructive to new sales engineers and also serve as a check for the old timers.

Organizational News

Detroit Diesel Appoints

James A. Hall has been appointed to the newly created position of chief project engineer at Detroit Diesel Engine Division, General Motors Corporation.

Mr. Hall, who joined the division in 1940 as an experimental engineer, was formerly engineer in charge of series 110 engine development. In his new capacity, he will have jurisdiction over the engineering laboratory, the engineering model shop and the project engineering staff.

His previous assignment will be filled by his former assistant, E. A. Chapin, who joined the division in 1938.

Cummins Sales & Service Promotes

Promotion of W. N. Eason from shop foreman at Oklahoma City, Oklahoma, to service manager at the same location has been announced recently by Cummins Sales & Service, Inc.

Eason started with the company in 1947 as a mechanic in Wichita Falls, Texas, and spent three years as field service mechanic in that city. In 1950 he was transferred to Oklahoma City as shop foreman and has been in that capacity until his recent promotion.

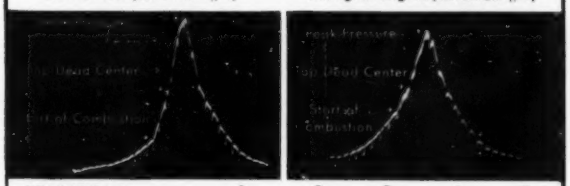
"pulse-measured" Diesels give...

MORE POWER, LESS WEAR

Results of Diesel "Full Load Test"*

Photo shows conditions at start of test (condition #1)

Optimum injection and peak pressure timing for engine (condition #4)



CONDITIONS	1	2	3	4	5
Start of Injection	29° BTC	26°	24°	23°	21°
Maximum H.P.	1048	1056	1073	1084	1026
Start of Combustion	12.5° BTC	7.5°	4°	3.5°	3°
Peak Pressure Location	8° ATC	10°	12°	12°	12°
Max. Firing Pressure	988PSI	923	872	860	835

NEW LINEAR Pressuregraph

MEASURES & RECORDS

Explosion, gas or hydraulic, pressure in internal combustion or jet engines, injection pumps, pipe lines, compressors.

Completely re-engineered, it now offers a more accurate and detailed picture of the firing, of regular and instantaneous pressure variations . . . up to 200,000 separate pressures measurements per second.

The **Linear Pressuregraph** provides linear stabilized measurement of pressure rise with time (vacuum to over 10,000 PSI), broad frequency response (zero to over 20,000 CPS). In addition, it offers these exclusive features: Greatly simplified pickup; temperature and drift compensated; permits up to 200' of pick-up cable to be used.

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Measures dynamic or static displacement, vibration or movement of any metal body **without** physical contact.

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This is our reply . . . and at the same time a means to expand our service to the diesel industry and all the men in it.

Please address all subscription orders and questions on the above to the: Circulation Manager

DIESEL PUBLICATIONS

192 Lexington Avenue

New York 16, N. Y.

EMD Director of Sales

Promotion of Paul R. Turner from eastern regional manager to director of sales of Electro-Motive Division of General Motors was announced recently. He succeeds Nelson C. Dezendorf, who had recently been made vice president of GM and general manager of EMD.

Paul R. Turner

Mr. Turner joined the White Motor Truck Company in 1918 and served in its national sales department until 1921. It was while establishing branch offices in Denver and Salt Lake City that he became associated with Mr. Hamilton, then wholesale manager for White, and the two men started the preliminary planning that led to establishment of Electro-Motive.

In 1952 Mr. Turner established the first Electro-Motive office in New York City. He remained there directing the expanding sales activities in the eastern half of the United States.

New Thor Sales Manager

Arthur H. Nelson has recently been appointed manager of electric tool sales in the Chicago branch of Independent Pneumatic Tool Co., manufacturers of Thor portable power tools.

Nelson, long connected with automotive service industry sales, has been a Thor service engineer for the past several years. He has been night shift superintendent at the Aurora works and head of the subcontracting division.

Cummins Promotes

Promotion of J. T. Calnon from sales manager to vice president—sales was announced recently by Cummins Sales & Service, Inc.

Mr. Calnon's sales and service experience include work as district service manager at Houston and Wichita Falls, division service manager in Odessa, and sales manager in Fort Worth. He will be in charge of engine sales throughout the company's area of operations.

J. T. Calnon

Enterprise Changes

John H. Sheusner, formerly chief engineer of Enterprise Engine & Machinery Company, has been named manager of Engineering and Manufacturing. He is well established in the diesel engine business, having spent the earlier part of his life with engine manufacturers in the East. His activities with Enterprise have encom-

OVERSPEED GOVERNORS

Synchro-Start Overspeed Governors are made for shut-down at any predetermined RPM by either opening or closing a circuit and speed can be adjusted while the engine is running.

Rotating parts of the GF's run in sealed ball bearings, lubricated for life and equipped with tachometer drive take-off.

Rotating parts of the GK's run in two oilless bushings and are adapted to standard SAE coupling or gear drive.

All models can be mounted in any position and an angle drive attachment can be furnished for GKA and GKM.

For further information write for Bulletins 409 and 409-A

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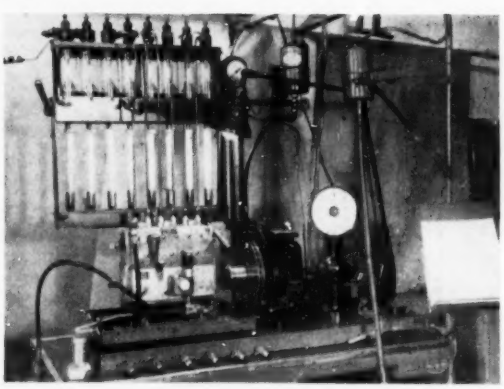
DIESEL INJECTION SERVICE



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AMERICAN BOSCH
BENDIX SCINTILLA

E. A. WILDERMUTH, Inc.
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MA. 2-7700

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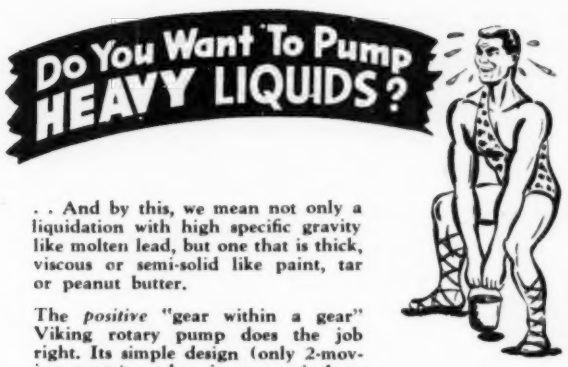

. . And by this, we mean not only a liquidation with high specific gravity like molten lead, but one that is thick, viscous or semi-solid like paint, tar or peanut butter.

The *positive* "gear within a gear" Viking rotary pump does the job right. Its simple design (only 2-moving parts) makes it economical to buy, low in cost to operate and extremely easy to service.

Its size range, ½ to 1050 gpm, and its adaption to any mounting arrangement, makes it the positive pump of the design engineer.

Its simple, rugged design makes it the preferred pump of the operator. Both get a break when VIKING is specified.

(Did you know Vikings will operate equally well handling light liquids too . . . as light as liquified petroleum gas?)

Send for descriptive 8-page folder today . . . Series 52SD.

VIKING AN HONORED NAME IN PUMPING

See Our Catalog in SWEETS

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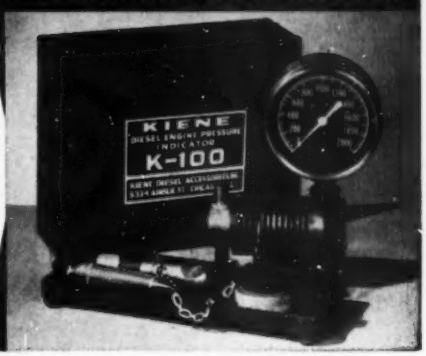
Cedar Falls, Iowa

SAVE MONEY BY *KNOWING* WHEN TO OVERHAUL YOUR DIESELS

KIENE DIESEL INDICATOR will tell you Compression and Firing Pressures . . . *FAST*



WHY GAMBLE?

With the KIENE DIESEL PRESSURE INDICATOR, you waste no money on costly overhauls done too soon—take no risk of putting off overhauls until too late.

The KIENE INDICATOR tells, reliably by accurate measurement of compression and firing pressures, when your engine needs attention.

SIMPLE—no complicated adjustments. **RELIABLE**—not affected by heat. **ACCURATE**—effects of friction and inertia eliminated. **RUGGED**—only one moving part. **COMPACT**—weighs less than ten pounds.

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passed every manufacturing activity, including recent development of a new line of marine and stationary diesel engines.

In his enlarged activities Mr. Sheusner will retain his former interest in all development phases with special attention to correlating design, development and manufacturing to meet the needs of expanding sales.

John H. Sheusner

Leonard O. Mjolsnes

Leonard O. Mjolsnes will replace him as chief engineer. Mr. Mjolsnes has spent many years in design and development work with General Motors Detroit Diesel Engine Division, Baldwin Locomotive Works, Scintilla Magneto Division of Bendix Aviation Corp., plus municipal power plant design work following his graduation from the University of Minnesota in 1935. His new duties will be chiefly concerned with further developments of diesel engines with supervisory handling of the other manufacturing divisions of the company.

Detroit Diesel Works Manager

Albert F. Davis, administrative engineer, Detroit Diesel Engine Division of General Motors Corporation has recently been appointed works manager. He succeeds George A. Zink, who has been named assistant general manager of the Fabricast Division at Bedford, Ohio.

Mr. Davis, a 1928 graduate of the University of Notre Dame, joined the Research Laboratories Division of General Motors in September, 1929. He was transferred to the Cleveland Diesel Engine Division in January, 1935, remaining there until November, 1936, when he was transferred to a product study group, engineering staff of GM Detroit, to aid in the development of a new railroad diesel engine for the Electro-Motive Division.

Albert F. Davis

Mr. Davis also worked on the development of a smaller diesel engine for general power purposes, and in November, 1937, shortly after Detroit Diesel was founded, he was named director of the laboratory. From 1941 to 1944 he was assistant to the general manager, and from 1944 to 1949, general superintendent of production. He was named administrative engineer in 1949.

Penn Changes

Penn Controls, Inc., has made several changes in its management and sales organization.

R. S. Penn has been appointed vice president for operations and E. B. Maire, vice president and director of sales. J. M. Reid, controller, has been appointed as a member of the executive committee. M. E. Henning, formerly executive vice president, has resigned.

Permutit Research Director

Martin E. Gilwood has been appointed director of research of The Permutit Company of New York City.

Mr. Gilwood is a graduate in chemical engineering from Rensselaer Polytechnic Institute. He has risen from the positions of research engineer to assistant manager of research to manager of chemical research and finally to director of research.

He will be responsible for all operations of research, analytical and pilot plant laboratories at Birmingham, N. J., and for market research activities from his office in New York.

Worthington Names Vice President

Worthington Corporation has elected C. K. Hood, formerly manager of the

C. K. Hood

New York district sales office, to a vice presidency. He will be responsible for the direction of the activities of the Public Works, Steam Power, Deaerating, Water Treating, and Steam Turbine Divisions and will report to T. Cruthers, vice president.

Mr. Hood, a graduate of Iowa State College, started his career with the corporation in 1918 and has been manager of the New York district sales office since 1930.

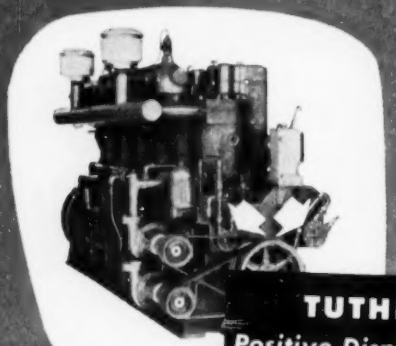
W. J. Van Vleck, present manager of the Atlanta district sales office, will succeed Mr. Hood as manager of the New York district sales office. C. W. Kramer, resident general line salesman in Birmingham, Ala., will succeed Mr. Van Vleck as manager of the Atlanta office. I. W. Leggett, general line salesman at Charlotte, N. C., has been appointed manager of the Charlotte branch office.

American Brake Shoe Appoints

W. Frank Kelly was appointed assistant vice president, and John E. Holtman was appointed general superintendent of foundries of the American Manganese Steel Division, American Brake Shoe Company.

Mr. Kelly has spent his entire working career in the operating department of the American Manganese Steel Division. Starting as foundry clerk in 1925, he became works manager in 1941, and has been general superintendent of foundries since 1946.

For POSITIVE LUBRICATION



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Positive Displacement
PUMPS

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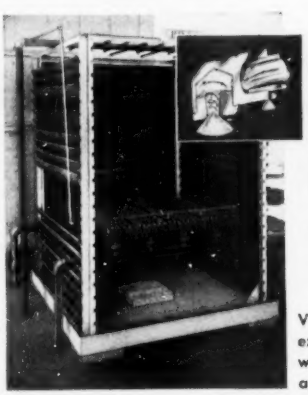

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View showing placement of heat exchange coils in cooling tower with inset illustrating spraying action of nozzles (at top).

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PREMAX
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OF COMPRESSION AND
FIRING PRESSURES
OF EVERY TYPE OF DIESEL ENGINE

ONE OF THE FEATURES
Responsible for Its Overwhelming
Preference by Leading Diesel
Manufacturers and Operators

Successive readings may be taken rapidly since no venting of the instrument is required between readings. No closing of valves required to change from firing pressure to compression pressure reading.

For other features, write for Bulletin 294

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HOSE LINES

FITTINGS are detachable and reusable. For on-the-spot hose line replacements cut bulk hose to required length and attach fittings. It saves time and money, and reduces inventory.

HOSE is tough, durable and fire resistant. Ideal for use with hydraulic fluids, lubricants, water, gasoline, Diesel fuel, air and many other fluids.

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Aeroquip Products are fully protected by Patents in U.S.A. and Abroad

Mr. Holtman has been works manager of the Division's Chicago Heights plant since 1946. He started in 1930 at the Denver, Colorado plant, and was works manager there and at the St. Louis, Mo., plant before transferring to Chicago Heights.

Bruno S. Weselis, formerly assistant works manager, has been appointed works manager at the Chicago Heights plant to succeed Mr. Holtman.

Paul H. Bohlen, formerly division trackwork engineer has succeeded Mr. Weselis as assistant works manager.

Dollinger Appoints

The appointment of two new district representatives has been announced by the Dollinger Corporation, Rochester, N. Y., manufacturers of "Staynew" filters.

Sabel E. Baumm, Dixie Engineering Co., Birmingham, Alabama, has been appointed district representative in Alabama, Western Florida and Marion, Hamilton, Bradley and Polk Counties, Tennessee.

Roy A. Stipp of Greenville, South Carolina, has been appointed district representative for North Carolina, South Carolina, and Eastern Tennessee.

New Cummins Vice President

E. D. Tull has been named to the newly created position of vice president for personnel and plant, at Cummins Engine Company, Inc. He will head a new Division of the company which will be responsible for all personnel activities and plant construction and maintenance.

E. D. Tull

Mr. Tull started with the company in 1928, and became foreman of the machine shop in 1938. Two years later, he was named superintendent of the machine shop and, in 1942, became assistant works manager. Before his present promotion he was manager of manufacturing, a position which he held since April, 1950.

Morse Chain Engineer

Morse Chain Company recently announced the appointment of E. E. Wesselhoff as assistant chief engineer.

Mr. Wesselhoff began his employment with the company in 1920, and prior to this appointment was branch office manager of the Boston office.

Mr. H. N. Tyler has assumed his duties in charge of the Boston Sales territory.

Baldwin-Lima-Hamilton Changes

J. R. Weaver, vice president—Defense and Special Products—Eddystone, has resigned to accept a position on the staff of the recently appointed vice-president in charge of manufacturing at Westinghouse Electric Corporation. The foundry, defense and other special products previously under his supervision will be combined with the Southwark shop into one

group to be known as Southwark and Special Product Division, which will be under the direction of R. B. Crean, vice president.

Walter A. Rentschler has been appointed vice president in charge of the Eddystone Division. He was previously vice president in charge of the Lima-Hamilton Division of the corporation and will continue in charge of the Hamilton plant, which will come under the immediate supervision of J. F. Connaughton, who has been appointed general manager of that plant. This arrangement will serve as a means of promoting closer coordination between similar activities and overall operations of these two plants.

Alex Smith has been appointed manager of a newly created export sales department which is being established on a company-wide basis to serve and coordinate the foreign sales activities of all divisions. C. A. Campbell, formerly head of export sales for the Eddystone Division, will become assistant manager of the new export sales department. The headquarters of this department will be located in New York City.

Mack Appoints

F. W. Beardslee, vice president of Mack Motor Truck Corporation, has

F. W. Beardslee

been appointed general manager of the company's Export Division. He was formerly assistant general manager of the Division. Manager of the Fire Apparatus Division for 12 years, he has been associated with Mack since 1919. He will continue to make his headquarters in the New York office.

Mr. Beardslee succeeds Mr. H. E. Seanor, who is retiring after a long career in the automotive industry, the last thirteen years of which he spent with Mack.

GM Vice President

The board of directors of General Motors at a recent meeting elected Nelson C. Dezendorf a vice president of the corporation. He was appointed general manager of Electro-Motive Division a short while back.

Mr. Dezendorf, who received a degree in engineering from the University of California in 1921, started with General Motors Acceptance Corporation in 1922. He became a vice president of GMAC in 1931 and in 1941 was made a director and member of the executive committee.

He relinquished these duties with GMAC in October, 1941, when he was appointed general assistant to the vice president in charge of the distribution staff of General Motors. He served for 18 months as director of the distribution staff before being appointed director of sales at Electro-Motive Division in June, 1945.

These Diesel Lubricating Pumps

Nos. 53 & 55
ROTARY GEARED PUMPS
with Helical Gears
and Roller Bearings

. . ." grow old GRACEFULLY"

HERE ARE exceptionally long-lived, efficient pumps for your diesel's pressure lubricating system up to 200 p.s.i. Nos. 53 & 55 Brown & Sharpe Rotary Geared Pumps have very accurate helical gears and roller bearings . . . provide smooth flow at high speeds. Leakage is prevented by mechanical seal . . . no glands to wear out. Their long, trouble-free performance is proved in thousands of diesel installations. Available with capacities from 4 to 34.1 g.p.m. at 0 lbs. pressure. Write for complete Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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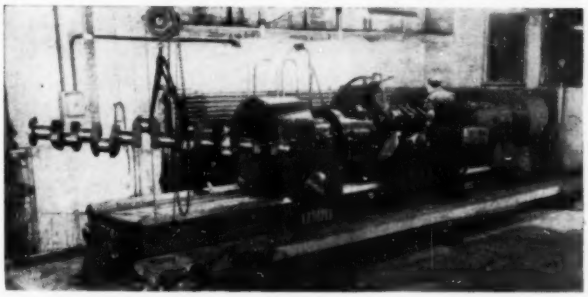

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Built up by metallizing
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Ground undersize.
Thermit welded.
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Engine repairs.

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Oil Flow in Bearings

(*Concluded from page 97*)

plotting the parameter containing Q′ against the reciprocal of the Sommerfeld number.

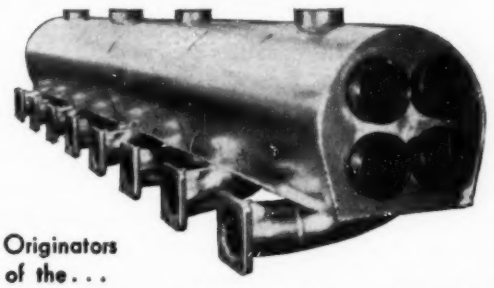
In obtaining the above information, it is necessary to separate the observed total oil flow, Q, into its components Q′ and Q″. For this purpose, a simple method was used. Briefly, the separation is done by plotting Qv against p for constant values of vN/P. On such a plot, the data for each value of vN/P fall on a straight line, the slope of which is equal to Q′v/p, while the intercept at $p = 0$ equals Q″v.

It is of interest to note that in the case of a bearing with a circumferential groove, the oil flow due to hydrodynamic-film pressure is negligible. However, for the other two oil-feed arrangements, this component is quite significant.

The good correlation of the parameter $Q''v/PC^3$ with Sommerfeld number, at different bearing clearances, is noteworthy. The differences obtained with bearings of different clearances when plotting $Q'v/pC^3$ against the reciprocal of Sommerfeld number are attributed to bearing out-of-roundness caused chiefly by deformation under load.

Save...
with Precision Manifolds
built by FLORI

fabricated from "pre-machined" parts
. . . ready for attachment to the engine



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of the . . .
"Insulation Filled" Exhaust Manifold
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5 cyl. 12½ x 15 4 cycle #10347. With 250 KW 400 RPM 3/60/220-440 or 2200 generator, exciter and swbd. if desired. Has been completely rebuilt by us using new replacement parts. Large quantity of new parts go to purchaser.

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Diesel, Gasoline or Motor Driven
1 to 1,000 KW
Motors, Controls, Transformers, Switch Gear

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WANTED G. M. "71"

Discarded injector parts & assemblies. 10 to 1000

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Pedrick Sales Manager

Wilkening Manufacturing Company, maker of Pedrick piston rings, has announced the promotion of Ralph W. Doherty to the post of sales manager of the Replacement Division. He will make his headquarters at the main office in Philadelphia.

Ralph W. Doherty

Mr. Doherty has been divisional sales manager of the West North Central states with headquarters in Kansas City. He is a graduate of the University of Arizona, worked for 5 years with Stuckey Auto Supply of Phoenix, Arizona, for 12 years with Aluminum Industries of Cincinnati as western sales manager, then eastern sales manager, and, before joining Pedrick, was manager of the Automotive Division of Service Supply Corporation of Philadelphia.

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Electro-Motive Changes

Promotion of Walter N. Fritts to general sales manager of Electro Motive Division, General Motors, was announced recently. He succeeds O. F. Brookmeyer who has been transferred.

The eastern region has been divided into two new regions: one at New York (still the eastern region), headed by G. M. La Riviere, formerly manager of the St. Louis region; and the other at Washington, D. C., to be known as the southeastern region, with R. L. Terrell, former assistant manager of the eastern region, as manager.

Other changes are: Frederick W. Walker, from district sales manager, Chicago region to manager, St. Louis region; George W. Rukgaber, from sales manager, East Central district, Chicago region, to sales manager, Western district, Chicago.

Mr. Fritts began work at Electro-Motive in December, 1935, starting as a draftsman in the engineering department. Three years later he was assigned to the chief engineer's staff as a junior engineer and six months later he became an assistant engineer. In June, 1943, he became assistant section manager and took over commercial engineering activities of the engineering department. In April, 1945, he transferred to the sales department as sales engineer and in November of that year became manager of the newly formed sales engineering section. He became assistant general sales manager April 7, 1949.

Mr. La Riviere, who has been regional manager of the St. Louis region since March, 1947, joined Electro-Motive as district sales manager at Washington in October, 1944.

Mr. Terrell, who has been assistant regional manager of the New York region since April, 1950, joined the Division as service engineer in 1919. In 1946 he became district sales manager at Washington, and then general parts engineer.

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Link-Belt Elects

Link-Belt, at a recent annual meeting, increased the number of directors from 12 to 14. The two new directors are Robbert C. Becherer, executive vice president, and William J. Kelly, president of Machinery & Allied Products Institute.

At the directors' meeting that followed Robert C. Becherer was elected president to succeed George P. Torrence, who is retiring from active service in accordance with the company's retirement plan. All other officers were re-elected.

Mr. Becherer joined the company in 1923, upon graduation from Purdue University, and was appointed general manager of the Eward plant in Indianapolis in 1947. He was elected vice president in 1951 and later in the year was appointed executive vice president, with headquarters in Chicago.

Mr. Torrence has been re-elected a member of the board of directors and will serve as a member of the executive committee.

Van Norman Company Elects Officers

Charles R. Crowder, vice president and general manager of The Van Norman Company, has been elected first vice president and a member of the board of directors at a recent annual meeting of stockholders. All other directors were re-elected. They are Henry A. Field, William A. Hebert, Donald P. Hess, James J. Minot, R. W. Porter, Roger L. Putnam, James Y. Scott, F. D. Van Norman.

At the annual directors' meeting, T. W. Baush of Springfield, general export manager for Van Norman and its subsidiary, Morse Twist Drill and Machine Company, New Bedford, Mass., and George H. Dickinson of Westfield, Mass., sales manager for the Automotive Division, were elected vice presidents. Other present officers were re-elected. They are James Y. Scott, president; F. D. Van Norman, chairman of the board; R. W. Porter, treasurer and clerk.

Mr. Crowder has been connected with the company since 1929 when he became a member of the automotive sales staff. He became sales promotion manager in 1937; vice president in charge of the Automotive Division in 1945; vice-president and general manager of the company in 1951.

Mr. Baush is director of export operations for the company and its subsidiary, Morse Twist Drill, and has been connected with the company for 28 years.

Mr. Dickinson came to the firm 20 years ago as division manager, covering a number of mid-western states, with headquarters in Chicago. He was appointed sales manager of the Automotive Division in 1951.

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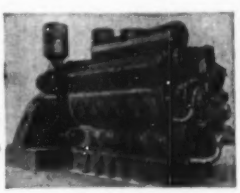

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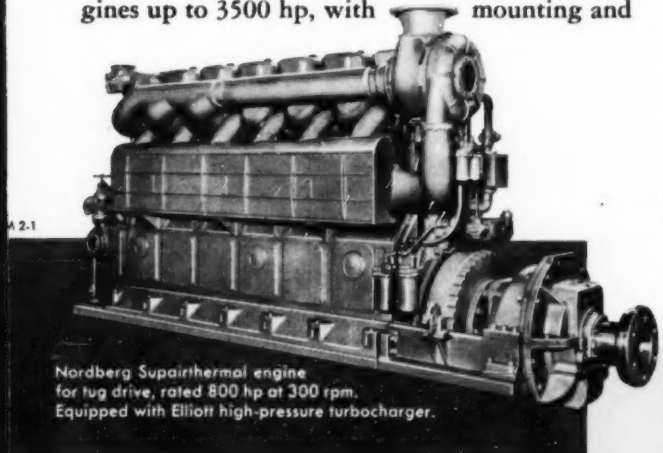

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